

Research of Blueness

-Lapis Lazuli in the Kizil Grottoes Murals of the Silk Road-

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<p>Tiivistelmä – Referat – Abstract</p> <p>The primary purpose of this thesis is to clarify the role and origin of the lapis lazuli used in the Kizil Grottoes in China. Particularly, it will seek to clarify how lapis lazuli was used, where it came from and who used it.</p> <p>The paper begins by considering the techniques used for purifying lapis lazuli, as well as its different uses. Following this, I consider the both the layout of and the different shades of blue present in the Kizil Grottoes Murals, as well as how the different shades were used to emphasise the importance of motifs.</p> <p>The purification of lapis lazuli, used to produce different types of blue colour, has a long history, and it has changed along with the development of new chemicals. This paper tries to illuminate how the different variations of the concept of “blueness”, expressed by three different Japanese kanji (Chinese characters), 青(ao) 碧(ao) 蒼(ao), influenced the roles and use of these different types of blue in the murals found in the Kizil Grottoes.</p> <p>This paper also considers the origin of the lapis lazuli in the Kizil Grottoes. Lapis lazuli used in the Silk Road has until now been believed to have been exclusively produced in Afghanistan; however, this thesis presents findings that cast doubt on this commonly accepted theory since lapis lazuli was present in significant amounts only in the 224th cave in Kizil. Instead, I propose the hypothesis that the lapis lazuli used in the 224th cave was not from Afghanistan but a much nearer place, namely, the Tibet and Qinghai regions of China.</p> <p>The study of art techniques and painting materials provides the primary theoretical background for this paper; however, other studies are also consulted. Specifically, archaeological and historical studies of the Silk Road, studies of the Kizil Grottoes, as well as other studies from the fields of linguistics, Buddhist studies, and art history, are all also extensively consulted.</p>			
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0. THESIS PLAN

In short, at the beginning of the paper, I describe the topic, the theory, and the method of the dissertation.

0. 1. Topic

The topic is blueness of lapis lazuli used in the Kizil Grottoes in China.

In particular, I concentrate on exploring the role and origin of lapis lazuli. Specifically, I focus on why lapis lazuli was used, who used it, where it came from, how it was used (why, who, where from, and how).

0. 2. Theory

The theory used in this paper mainly relates to the study of art techniques and painting materials in fine arts. Therefore, the archaeological and historical studies that have been major in the Silk Road studies, including the Kizil Grottoes, and also the perspectives of linguistics, Buddhism, and art history are, in this paper, complementary. Besides, the results of the chemical examination are also used in this paper as scientific evidence.

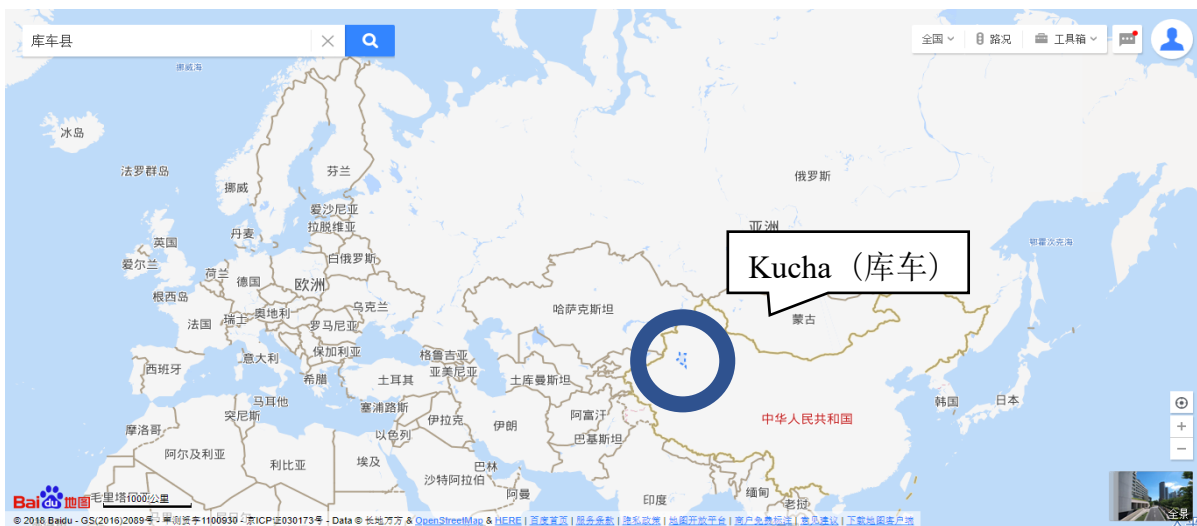
In other words, I use the knowledge of practical art on which the painters as the leading theory, also comprehensively cover with the previous research and the latest survey results.

0. 3. Method

Take three kinds of methods.

The first is the literature. The primary documents are the report¹ of the research² conducted in Japan since 2012 and the texts³ of fine arts used at Tokyo University of the Arts. I also used many previous studies such as Le Coq's research⁴. I would like to refer to the “reference”. The second is fieldwork. For this topic, I focused on visiting directly and looking at the objects directly with my own eyes. Moreover, lastly, research at related institutions. The latter two methods will be described in detail in <1. 3. My fieldwork and previous studies >, so please refer to that part.

※1 Location of Kucha in the world



¹ issued by Kanazawa College of Art, 2016, Ishikawa

² Sato, Ichiro (Principal Investigator), 2012-2015, “Study of painting materials and techniques of the Silk Road Grottoes murals”, Tokyo, JSPS KAKENHI Grant Number 24401021

³ Sato, Ichiro, and Oil Painting-Technique and Material Department of Tokyo University of the Arts (eds), 2014, “Oil Painting Technique and Material”, Tokyo, Tokyo Geidai Press

⁴ Le Coq, A. von, 1922-24. Die buddhistische Spätantike in Mittelasien, I-VII, Berlin :Reimer.

1. INTRODUCTION

The subject of this study is the blueness of the Kizil Grottoes. It is specifically about the lapis lazuli that was used as a blue pigment in the Kizil Grottoes Murals of the Silk Road. Besides, I try to describe in this paper art techniques and painting materials for the work on the motif of historical and religious themes in the Silk Road with the blue colour of lapis lazuli as the subject.

After the introduction (Chapter. 1), using historical, archaeological, Buddhistic and linguistic viewpoints, I give a basic description of the Kizil Grottoes in the second chapter. Then, in the third chapter, from the perspective of the fine arts, I describe the functional artistic theory related to this theme. Next, I will examine the blueness in the Kizil Grottoes in the fourth chapter. Finally, in the final chapter (Chapter. 5), I will attempt to form new interpretations and discoveries about the blue colour of lapis lazuli used in Kizil Grottoes and solve the main topics with the two questions, namely the role and origin of lapis lazuli.

The second chapter also includes a review of previous studies of the subject in the fields of traditional archaeological and historical research. In the third chapter, on art theory, I return to the essential stage of technique and material to have a clear definition. In particular, the third chapter is based on a practical viewpoint taking the painters as the primary object of observation. It can be thought that each of the painters can make various interpretations. Thus, I believe that the second chapter ultimately can unfold even the essentials such as what is <draw a picture>. Hence, the second chapter goes back to the fundamental essence of what it means to draw a picture. It is because we need the underlying artistic theory to research different meanings of the blue colour of lapis lazuli. Furthermore, in both the fourth and fifth chapters, I consider together the two fields covered in the previous sections by combining academic and

practical fields, ultimately possibly uncovering new sides that would have remained hidden if the two were studied independently.

The specific theme is the blue pigment used in mural painting, namely lapis lazuli. I will deal with the refining method of lapis lazuli, how to paint, how to arrange the paintings, who painted, where it was from, and the history of the mural paintings. Also, during a study conducted on the lapis lazuli paintings in the 224th cave in Kizil, the title of the Brahmi character was newly discovered. Deciphering this character also became one of the objectives of this work. Until now, there have been no integrated attempts at reading the Brahmi character and its motif, and all previous studies have focused on studying them separately. I think it is one of the outcomes of the research. Therefore, I will also describe it related with the research descriptions although it is not directly related to the study of blueness, lapis lazuli.

In other words, the primary purpose of this thesis is to find previously undiscovered interpretations by utilising perspectives from both practical art and humanities.

※2 Location of Kucha and Xining (Qinghai) in China



As for the research methods, there are three directions: in literature, on fieldwork, and research in local institutes.

First, regarding the research based on the documents, there are two main kinds of literature. The first is the latest survey that completed in Japan by the professor at Tokyo University of the Arts in 2015 while the other is the textbook on the fine arts of the university.

The second method involved doing field work on-site to study the paintings. Specifically, during the period from 2016 to 2019, I conducted surveys mainly in China and Japan, focusing on the related relics, museums, universities and other research facilities.

The third method involved a study at a local university. Before I entered Helsinki University in 2015, I visited the Technical Materials Laboratory at Tokyo University of the Arts in Japan once a week from 2013 to 2015, and after having interacted with local artists. I gained insights into fine arts, which is helpful for this paper to deepen it.

I thought it was important to see and feel the artistic objects by myself because of the artistic nature of the subject matter. I felt the importance of personal observation in dealing with the theme related to the colour of lapis lazuli's blue colour.

※3 Location of the Kizil Grottoes



Regarding the theories, I chose two main study objectives for this dissertation.

First, I will analyse the murals in fine arts framework demonstrated in the report (Sato, 2016) of the research (Sato, 2012-2015) in comparison with other studies, such as linguistics, culture and history, Buddhist studies, and so on. Then, I proceed to make a comparison with previous studies on fine arts techniques and painting materials study based on the traditional art theory of all over the world, including not only conventional western but also oriental China and Japan. In other words, the first involves using interdisciplinary methods; the second involves a comparative approach between different periods and regions.

※4 Outlook of the Kizil Grottoes (the western area) ①



1. 1. The Silk Road and the JSPS⁵ Research

First of all, in this chapter, I explain the leading researches.

The subject of the research is the Kizil Grottoes Murals (克孜尔千佛洞) in Kucha (库车), Xinjiang Uygur Autonomous Region (新疆维吾尔自治区) in China. The paper is based on the latest field investigation executed on the JSPS KAKENHI Grant Grants (日本學術振興会科学研究費補助金) from 2012 to 2015, as named “Study of painting materials and techniques of the Silk Road Grottoes murals” led by the principal investigator Ichiro Sato (佐藤一郎). This survey was conducted mainly by Japanese artists who had taught at Tokyo University of the Arts (東京藝術大学) in Japan as professors. Therefore, they had the perspective of fine arts.

※5 Outlook of the Kizil Grottoes (the western area) ②

It is an encounter with this survey that the reason why I chose the Kizil Grottoes, which can be said to be not very known research object, as a topic from among the many caves on the Silk Road.

According to the surveys, more than 200 murals have been discovered in Kizil; however, in this essay, I concentrate on a specific mural of the Kizil Grottoes: I focus

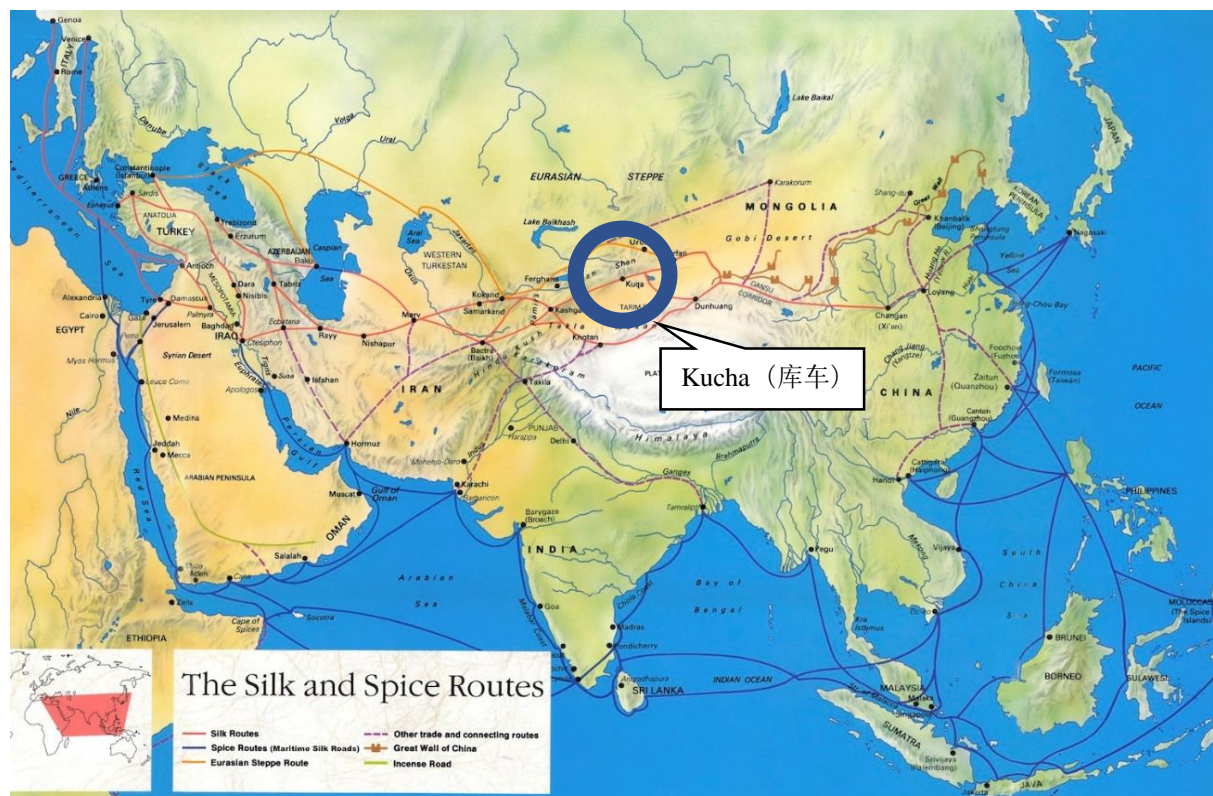


⁵ Japan Society for the Promotion of Science 《独立行政法人日本學術振興会》; JPAS in abbreviation

on the 224th cave⁶ of the Kizil Grottoes. The 224th cave is extraordinary and worthy of remark among other Grottoes for its brilliant blueness of lapis lazuli. Also, it is characterised by, for example, its description written in Tocharian B, its multilayer structure system composed of a support, ground, underpainting, overpainting, and its painting process.

The study of the Silk Road (丝绸之路) has a long history and has been addressed by many pieces of research all over the world from a perspective of fields such as archaeology, historical science, Buddhist studies, linguistics, and art history, and so on. However, we could find less previous research on the Silk Road dealing with artists, while the thesis (Ichiro, 2016) have mostly dealt with the art techniques and painting materials for the Kizil Grottoes Murals.

※6 Map of the Silk Road ①



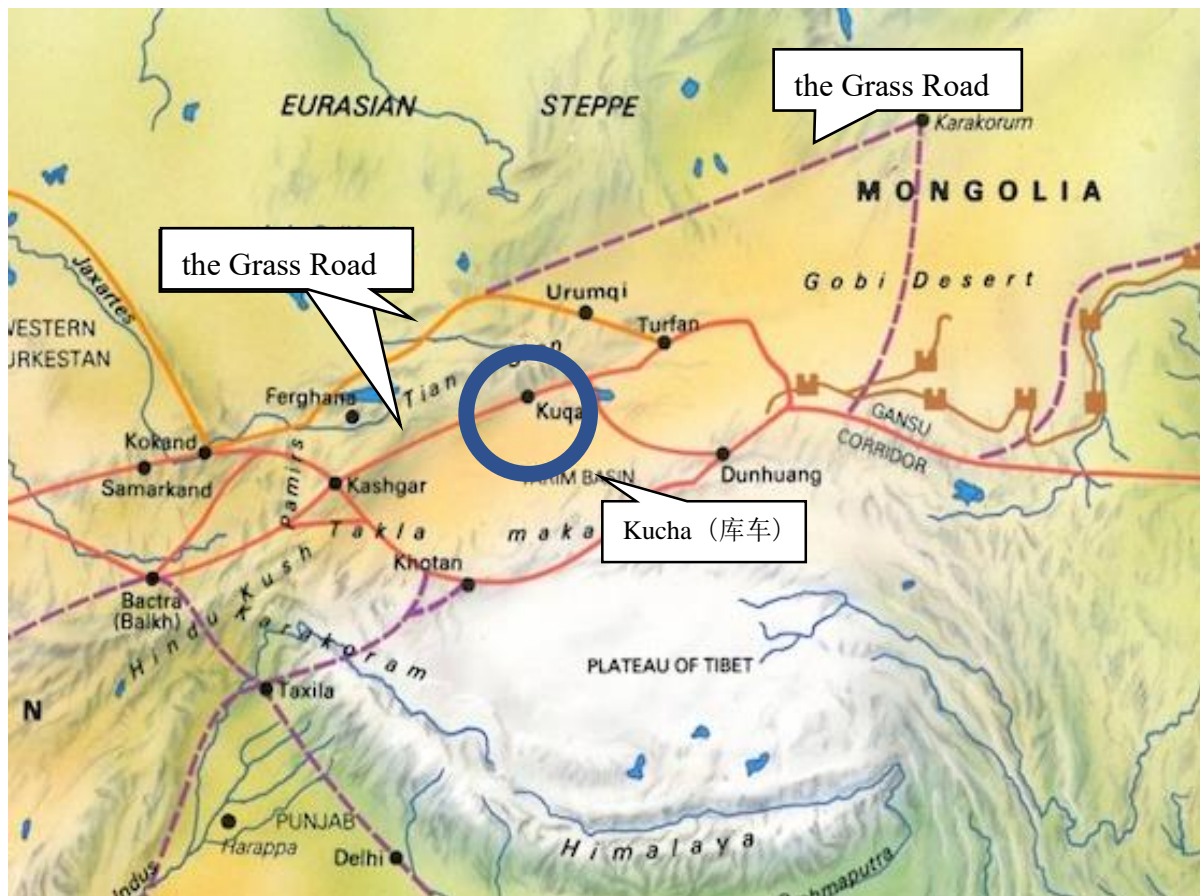
⁶ It was originally named “3.Anlage Höhle 5, Höhle mit der Mâyâ der dritten Anlage” by German when it was discovered. Chinese called it 《3 区佛母窟／第5窟》, and in Japanese 「第3区マヤ窟／第3区／第5窟」

1. 2. Art Techniques and Painting Materials (Dimensional Transformation by the Arts)

I would like to point out that the Kizil Grottoes Murals have two unique features, I think, namely (1) the murals depict sacred themes and (2) they were painted in caves.

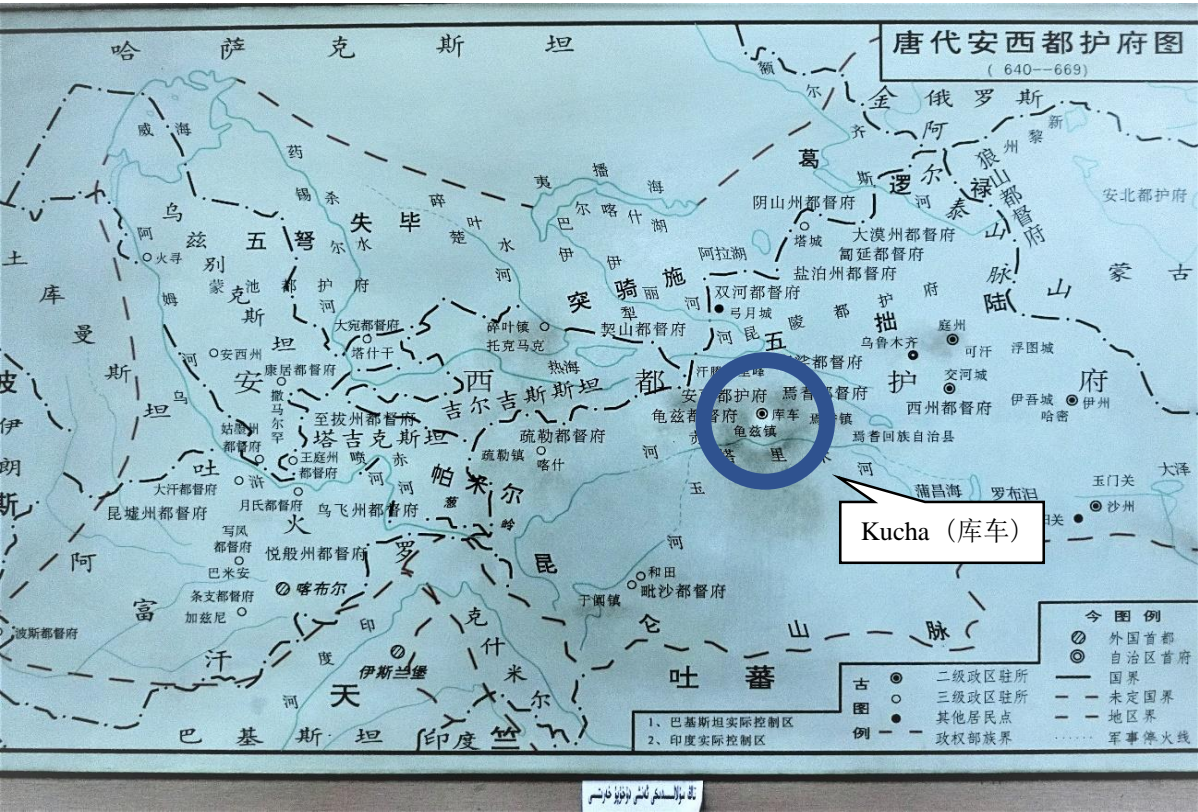
We usually perceive that pictures are drawn or painted on canvas or another flat surface, while the motifs around us in the real world are always reliable and vivid. In this respect, I think the techniques of fine arts enable us to covert objects in our three-dimensional surroundings into a two-dimensional form. Furthermore, especially regarding religious topics, the motifs arise out of records of ancient events. In this case, drawing the religious should be regarded as a time shift of sorts, where the concept of time is added into three-dimension (namely a four-dimensional

※7 Map of the Silk Road ②



object) morphs into two. Besides, it can also refer to myth or bibles. In this case, the subject matter does not necessarily exist in the physical world but comes from another dimension such as heaven. Therefore, in this case, the intentionality of fine arts involves a process whereby the imaginary realm assumes a material form, transcending time and space, the four dimensions morphing into two. This phenomenon, which was drawn by the unique and original way of fine arts is the object of the study on art techniques and painting materials. From the ancient time, artists have been engaged in the never-ending trial for shifting the world order by excellent composition and colouration.

※8 The old map in Tang Dynasty of the Protectorate General to Pacify the West ①



Therefore, the researches on art techniques and painting materials are so unique that they tend to be independent, which means that other academic fields have hardly mentioned and related to this fine arts sphere. Furthermore, these studies require practical skills as fine artists such as drawing, drawing. Otherwise, people would have difficulties in sympathy with them because they have never experienced and acquired special artistic skills. This condition makes the collaboration more complicated, and many of the previous researches had hardly appeared alongside other academic fields.

1. 3. My Fieldwork and Previous Studies

I have conducted the fieldwork in China in October of 2018 on a Chinese Government Scholarship (中国政府獎学金): Kucha (库车) as the location of the Kizil Grottoes Murals and ancient Qiuzi country, Urumqi (乌鲁木齐) as the primary field of the Xinjiang Uygur Autonomous Region and for the national museum, Dunhuang (敦煌) as one of the main places of the Silk Road, and then Qinghai (青海) to trace where lapis lazuli came from. Also, I went to Russia to see the murals of the Kizil exhibited in the Hermitage Museum in St. Petersburg in March of 2019. Additionally, I visited the special exhibition of the Kizil Grottoes in Beijing in October of 2018 during my stay in China.

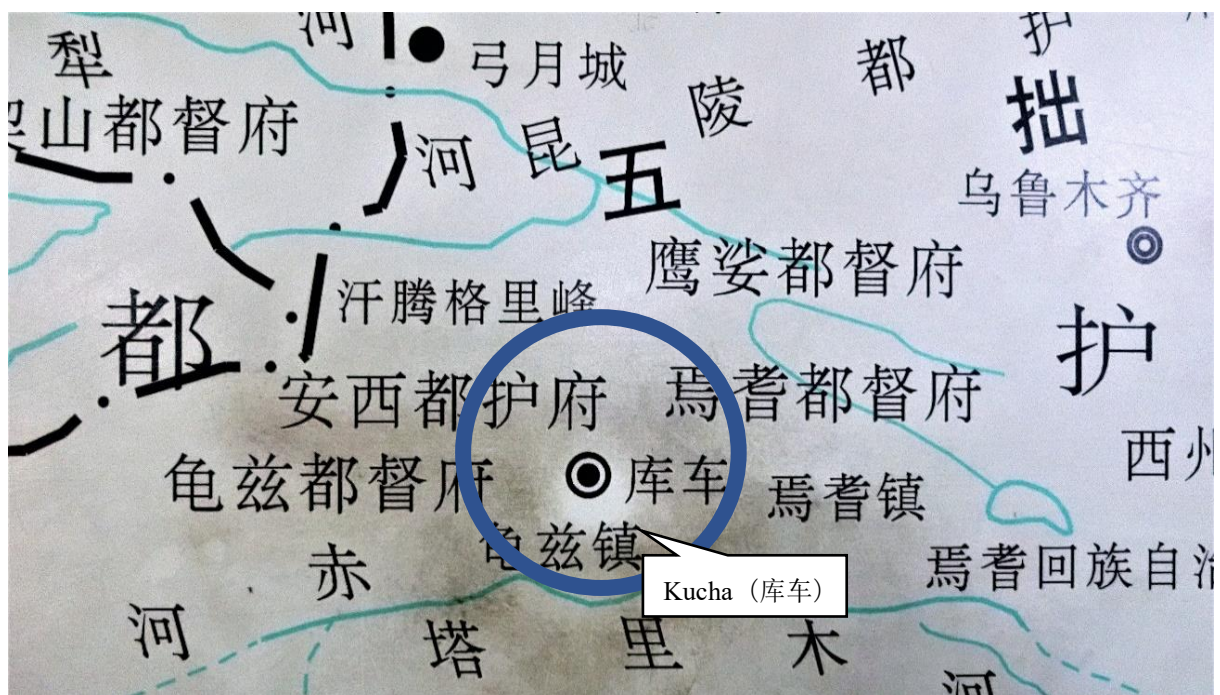
As noted, I analyse the topics not only in terms of fine arts but also in comparison with other studies, such as linguistics, culture and history, Buddhist studies, and chemistry, because I think I can use my own various experience and expertise. I am a master degree student whose supervisor professor Juha Janhunen is a linguistic scholar on Altaic studies in Helsinki, while I have worked on other academic fields such as archaeology, historical science, Buddhist studies, and art history. Also, I studied ancient Greek philosophy especially on Aristotle works in Hokkaido, Japan when I was a bachelor student. After graduating my

bachelor course, I worked for a chemical firm in Japan where I could expand my knowledge of scientific analyses on chemical while I went to an art university where I could see many works of illustrious fine artists. An encounter with one of the professors of the art university motivated further work on the master degree thesis that I am presently writing, namely, Ichiro Sato. He is the emeritus professor of Tokyo University of the Arts. He directly enquired about the title written in Tocharian B in Kizil when I researched at Kyoto University as a free mover of Helsinki University in spring of 2018. Then, I finally determined to properly research into his investigation and select it as the main topic of the thesis.

2. THE KIZIL GROTTOS MURALS OF THE SILK ROAD

Here, based on the previous researches on the Kizil Grottoes, I explain fundamentals. As a research policy, after obtaining knowledge in the literature, I visited the sites as much as

※9 the old map in Tang Dynasty of the Protectorate General to Pacify the West ②



possible, looked at the actual things, and took a record with photographs and notebooks, then utilised it in this paper. Above all, I will mainly examine the results of fieldwork in China conducted in October 2018.

2. 1. Buddhism and Language of Ancient Qiuzi

In the middle of October 2018, I conducted fieldwork for three weeks mainly in the Xinjiang Uygur Autonomous Region of China. Above all, I stayed in Kucha for four days from Beijing via Urumqi, and I surveyed by myself with the private tour guide.

When we go to Kucha, we can see the bare ground where the reddish-brown wasteland spreads. Heading from the airport or the train station to the city, we can see the scenery of a modern town of Uighur people, not much more sophisticated than Beijing, Shanghai, or Urumqi. However, if we run for 15 minutes by taxi, the buildings will be reduced rapidly, and there will be a flatland house made of soil and a wasteland where deep grass with moss can be seen everywhere. Also, if we run for 30 minutes from the city, we will quickly disappear from their homes and be drawn into the world of wasteland and desert. Even the rivers are reddish, so it is difficult to see lush greenery in reddish brown grounds any more in Kucha. Although the mountain range can be seen in the distance, there is no green there either, and the contrast between the brown plane and the deep blue sky is extreme on a sunny day.

The first thing I thought soon after arriving in Kucha was why the blue colour of that lapis lazuli glowed so beautifully in Kizil, and I guess it should be because of the extreme brownish of the Eastern Turkistan.

Now, start to explain academically based on the research books⁷, Ancient Qiuzi (龟兹) was a strategically located country of the Silk Road situated in Central Asia, which is nowadays relevant to the place near the current prefecture of Kucha (库车), Aksu (阿克苏), in the Xinjiang Uighur Autonomous Region (新疆维吾尔自治区) of the People's Republic of China (中华人民共和国). Kucha was critical as a vital place of the east-west intercours in the history of Buddhism when it was transmitted for the first time and at its peak.

Various names have been made other than Qiuzi (龟兹) depending on the era such as Qiuqi (丘兹), Quqi (屈兹). For example, In “Great Tang Records on the Western Regions” 《大唐西域記》 written by Xuanzang (玄奘) which became the source of the “Journey to the West” 《西游记》, Qiuzi was written as Qufu (屈支). In this paper, however, I decide that Qiuzi (龟兹) is used to refer to this country.

In the first place, the name of “the Silk Road” came from the fact that the German geographer Richthofen in the 19th century used the word “Seidenstraße” in his own book “China” (1877)⁸. In the book, he pointed to the routes that cross from east to west the Eastern Turkestan, which is currently equivalent to the Xinjiang Uighur Autonomous Region. That is the route of “the Oasis Road” 《オアシスの道》. On the other hand, however, the term can be used to broadly refer to international trade conducted throughout the Eurasian world, including the north-south trade route and the sea trade route. We call it “the Silk Road” including not only the “the Oasis Road” but also both the northern as “the Grass Road” 《草原の道》 and the ocean route as “the Maritime Road” 《海の道》.

⁷ 新疆ウイグル自治区文物管理委員会, 拜城县キジル千仏洞文物保管所編, 1983, 『中国石窟キジル石窟』, 第一卷-第三卷, 平凡社

⁸ "China, Ergebnisse eigener Reisen" (5 Bände mit Atlas, 1877-1912), Ferdinand Freiherr von Richthofen

Kucha was a principal oasis city of the Silk Road and on the route of “the Oasis Road”. In detail, Kucha was geographically located along the southern foot of the Tianshan (天山) Mountain Range on the northern side of the Tarim (塔里木) Basin. Also, it was one of the oasis cities of “the Oasis Road”, which bound for Pamir (帕米尔), via Kohla (库尔勒), Kucha (库车) and Kashgar (喀什). Also, it was located just midway between Turpan (吐鲁番) and Kashgar. It is thought that the ethnicity derivation should not be from Han Chinese (汉族), but Aryan, so Indian and Iranian culture was also seen there.

Historically, after the era of Xiongnu (匈奴) peoples that had spread from the Mongolian Plateau, the reign of Emperor Wu (武帝) of the Former Han (西汉), from 141 B.C. to 87 B.C, controlled the area from Western Corridor(河西回廊) of the Yellow River (黄河) to Tarim Basin and the Qiuci was also under the control of the Former Han. From this time, it began to appear in historical records under

※ 10 the Qiuci Castle



the name of “Qiuci”. Then, Han Chinese tried to expand the western regions, for example, in the later Han (東漢), Banchao (班超) was set up the Protectorate of the Western Regions in 91 A.D, and Kanyin (甘英) was sent to Daqin (大秦), which is regarded as current Roma, in 97 A.D. Later that, there appeared some declines of the Han Chinese dynasties. However, in 648 A.D, the Tang (唐) dynasty placed the Protectorate General to Pacify the West (安西大都护府) in the current Qiuci Castle (龜兹古城) area and once again played the centre of the Western Region.

As for the beginning of Buddhism, there has been no evidence in the historical materials, however, according to the description of ancient Chinese sentences to be relied upon, it found that from the end of the 3rd century to the beginning of the 4th century, a considerable number of ancient Qiuzi Buddhists came to the eastern area of China. It was already seen that Buddhism there was flourishing at that time. Later, there appeared some prominent monks during the Period of the Sixteen Kingdoms (五胡十六国) in the 4th century, for example, Fotucheng (佛图澄) who went to spread Buddhism throughout the regions in China was from Kucha. Moreover, in the same period, Jiumoluoshen (鸠摩罗什) whose mother belonged to the royal family of an ancient Qiuzi country was invited by the Later-Qin country (后秦) in 401 and engaged in the Chinese translation of Sanskrit scriptures in Chang'an (长安) until he died in 413 (or another theory claims in 409). It contributed to the popularisation of Buddhism in China. Then in the late Tang Dynasty, Xuanzang, who was very famous as “Two most Greatest Genius Lotsawas” 《五大译师》, ranking with Jiumoluoshen, returned from India on the Oasis route of the Silk Road and wrote “The Great Tang Dynasty Record of the Western Regions” 《大唐西域記》.

Qiuci was regarded as a critical point of the Western rule of the Han Chinese dynasty from the importance as its abilities internationally of the Silk Road and was widely put under the influence of foreign countries. After the latter Han rule was unravelled, it had developed its state structure after the 2nd century. However, since the end of the 6th century, it declined due to the Western Tejue (西突厥), and, in the mid-seventh century the Tang dynasty went to the western region, under the control of the Tofan (吐蕃) at the end of the Tang Dynasty, then became Uighurs since the 9th century, this period also saw the arrival of Islam to the region. Furthermore, to this day the area remains Muslims predominantly, and many Uighurs are living there and Uighur language continuing to be widely used.

Concerning languages, Uighur and common Chinese language (普通话) are mainly used there today. However, there used to be unique languages that have been called Tocharian dialects in the area. Unearthed documents revealed that Kucha people had used it at least until the Tang Dynasty. Tocharian is a dead language, which is considered to belong to the Indo-European Kentum family. It is mostly divided into A dialect and B dialect. Thus, Tocharian does not belong to neighbouring the Sino-Tibetan or Altaic in the language trees. However, it is regarded as an isolated and unique language among other Indo-European languages because, for example, it is a kind of synthetic language with agglutination. They used Brahmi scripts, and other similar letters called Tocharian alphabets. However, There have had a discussion about two Tocharian dialects as to whether Tocharian B should be referred to as Qiuqi language, compared mainly with the A dialect used in Yanqi (焉耆), Gaochang (高昌) area, nevertheless, I will not treat the problem as the central theme, and the dialect name “Tocharian B” consistently described in this paper.

When I visited Kucha in fieldwork, their conversations in Uyghur, I think, is very similar to Turkish accent. Furthermore, “Kizil” of the Kizil Grottoes has the meaning of "red" in Turkish (kızıl).

Moreover, when I walked around the Kucha, it seemed that no one used Tocharian but Uyghur. I met seven students from the Xinjiang Uyghur Autonomous Region, who studies in Minzu University of China (中央民族大学) and asked about the commonly spoken languages. They answered that they usually used Uigur or Chinese as a daily conversation while Tocharian was not used at all, and some of them did not know even the existence of Tocharian language.

2. 2. The Kizil Grottoes

Next, I explain the Kizil Grottoes that are dealt with in this paper as the main topic. In China, Buddhist caves of the Kizil Grottoes have been called “克孜尔千仏洞”, which means “the thousands Buddhas caves in Kizil”. They are located in the suburb of Kucha of the Xinjiang Uyghur Autonomous Region. The Kizil Grottoes are grouped on the cliffs opened along with the Mozart (木扎尔特) River on the Southwestern Route (in another word “Tianshan Southern Route”) of the Oasis Route of the Silk Road. It could be thought as one of the most important Buddhist temples relics of the oasis nation in ancient Qiuzi and had continued to be drawn for centuries since the caves playing a role as a Buddhist monastery in this area. Regarding the types of caves’ form, four models have been founded so far as (1) the central column caves (中心柱窟), (2) the large statue caves (大像窟), (3) the monk caves (僧房窟), and (4) the square-shaped caves (方形窟).

The surveys and researches on the Kizil Grottoes have been drawing attention not only for the investigation of the cave but also as a research and on the entire caves in China. One reason for this is that the Buddhist eastward was initially thought to have originated from Central Asia to the Xinjiang District of China. In the Southwestern Route area of the Silk Road, the ancient Qiuci region was the most popular area of Buddhism in history. Next, it is cited that the Kizil Grottoes were the largest cave group in the field of ancient Qiuci country. In the same area, 8 kilometres north of Kucha city, there was Subashi Buddhist Temple (苏巴什佛寺遗址) founded during the Wei-Jin-Nanbeichao period (魏晋南北朝), which was the largest temple of Qiuci area.

※11 The explanation at the entrance of the Kizil Grottoes



On the other hand, the caves have been founded 349 places in the Kizil Grottoes, and 236 caves were numbered there. Moreover, various types of caves have been seen in this area, and the period during which these caves were run was thought considerably long. The richness of these contents of the Kizil Grottoes and the importance of the position occupied themselves are already representative of the Chinese caves, which also has close relations with Central Asia and the Buddhist. Also, when I visited the site, an explanatory text was written in three languages of Uighur, Chinese and English at the entrance of the Kizil Grottoes (*Appendix I*).

Now, I follow the previous researches and studies by both the eastern and western scholars, referring to the research books⁹ and the report (Sato, 2016). In the field survey, the first record was left in China in the first half of the 18th century, from 1726 to 1736, which was written by Xie Jishi (谢济世) when he visited as a circuit-riding inspector (按察使) from Uliastai (乌里雅苏台) in present Mongolia under the order from a general. After that, Qishi (七十一) and Xu Song (徐松) in 1816 left recorded of the Kizil Grottoes and the Kumutula Grottoes (库木吐拉千仏洞) when They went back to Ili (伊犁) from Kashgar via Urumqi. Then, from the 20th century, Xie Xiaozhong (谢晓钟) published “Journey to Xinjiang” 《新疆游记》 in 1922 and then Huang Wenzhao (黄文弼) presented “Archaeological Record of Talimu Basin” 《塔里木盆地考古记》 in 1958, which have been thought as some of the significant records of this study.

Meanwhile, many researchers from outside China carried out some surveys in Central Asia in the early 20th century. For example, researchers from the great powers visited the Kizil Grottoes, including the German Grünwedel in 1906, Le Coq in 1913 and 1914, and the Japanese Otani Expedition team (大谷探検隊) in 1909 and 1913.

⁹ 新疆ウイグル自治区文物管理委員会, 拜城县キジル千仏洞文物保管所編, 1983, 『中国石窟キジル石窟』, 第一卷-第三卷, 平凡社

2. 3. The Research of JSPS KAKENHI Grant

Preceding works on those caves in Kizil area are mainly related to the academic field of so-called “Tunhuangology” (敦煌学) in China and Japan. It primarily focuses on philology research on Dunhuang area with the colour of the Oriental studies, however, which broadly includes studies on the Buddhist art history of murals’ paintings and sculpture, archaeological research on the caverns, and linguistics on local languages.

While their research fields are mainstream, however, research of art techniques and painting materials especially from scientific and material aspects have had poor prior analyses. Therefore, the study conducted on the Japan Society for the Promotion of Science (日本学術振興会) from 2012 to 2015 tried to explicitly clarify the aspects of technology, culture, and historical intercourse from the viewpoint of art techniques and painting materials based on fine arts studies. Besides, it conformed to the classical research results mainly by the reconnaissance team from Germany and the Beijing University (北京大学) Archeology Group and the Dunhuang Institute (敦煌研究院).

A survey focused on this paper is a part of Japan's scientific research grant subsidy project with the name of “Study of painting materials and techniques of the Silk Road Grottoes murals” 《シルクロード・キジル石窟の絵画材料・絵画技術の研究》. The scientific research grant subsidy project is a kind of research program granted by the Ministry of Education, Culture, Sports, Science and Technology of Japan (文部科学省), and extra-government organisation, the Japan Society for the Promotion of Science, aiming to remarkably developing the research of researchers belonging to Japanese research institutes. It is a large-scale and prominent project that has deeply contributed to the academic promotion of the country. This research falls under the category of “the basic research (B)” of the Japan Society for the Promotion of Science, under the jurisdiction of the Japan Society for the Promotion of Science. In the name of “Overseas Academic Survey” between 2012 and 2015,

Ichiro Sato was implemented as a research representative with a budget of 14,100,000 Japanese yen.

Until now, there have been many obstacles to research investigation in the Kizil Grottoes. For example, it can be said for other caves in the Silk Road as well, but the strong powers of the early 20th century such as Germany ripped murals and took them back to their countries, which caused the dispersion of the walls, then some of them were burned in the World War II. Another reason is that the contactless analysis was adopted for any fieldwork as a principle from the viewpoint of protection of cultural properties, as it was registered as a UNESCO World Heritage site as “Silk Roads: the Routes Network of Chang'an-Tianshan Corridor” in 2014, which made the protection management system much more stringent than ever. Also, due to the problems such as deterioration of security in the Xinjiang Uygur Autonomous Region, there are strict restrictions especially on surveys by non-Chinese peoples.

Regarding this survey, it was divided mainly into five items as below:

- (1) Creating the digital high-definition image data of the Kizil Grottoes Murals
- (2) Natural scientific survey and analysis on painting materials in the Kizil Grottoes Murals.
- (3) Natural scientific study on the age of formation of the Kizil Grottoes Murals
- (4) Iconography and historical survey on the locations and history of the murals' pieces of the Kizil Grottoes, which were brought to foreign countries
- (5) Colour reproduction restoration of the Kizil Grottoes Murals' painting.

I focus on the survey comprehensively and exclusively, but primarily concentrate on the research of painting techniques using high-definition image data and the chemical study of materials, mainly about pigments, in this investigation since there have been no good previous researches for them, and since sufficient investigation has not been completed yet in the report of this survey.

2. 4. Brahmi Scripts of the 224th Cave

In this chapter, I focus on the title written in Brahmi scripts although it does not relate to lapis lazuli directly. It is because this topic shows how the research influenced the previous studies and how it broke through the wall of prior studies.

As I mentioned in the introduction, I address the issues on the Silk Road with the latest research conducted by Japanese artists and scholars. I analyse the murals in the fine arts framework demonstrated in the central thesis in comparison with other studies,

※12 The part of Brahmi script of the west wall



such as linguistics, history, and Buddhist studies. As one of the examples, this survey found, a new masthead written in Tocharian. It was one of the important discoveries, which enabled to see the site of missing drawing in the 224th cave.

In this research (Sato, 2012-2015), the infrared reflection photography technology was newly implemented, which enabled to display the black line and the ink line disappeared by normal photographing. It is because infrared rays can reflect through the under-drawing in the lower layer through the painting of the upper layer. Therefore, this technology could find new letters in the west wall of the 224th cave. In the report (Sato, 2016), it was almost impossible to recognise the characters, but in fact, it had already been deciphered in China in 2013. It was, however, asserted that it was unclear at the time due to missing mural painting pieces and missing pigments on the surface. ¹⁰

※13 The part of Brahmi script of the west wall of the 224th cave in Kizil



¹⁰ 『敦煌吐鲁番研究(第十三卷)』, 中国敦煌吐鲁番学会. 他編, 「略論龜茲石窟現存古代期龜茲語題記」, 荻原裕敏, 2013, 上海, 上海古籍出版社, pp.371 - 386

These letters were written in ink on the plaster layer. As for the motif, the face of the Buddha, the chest, the arms, and the legs are fleshed by overplanted in orange-brown, while the skin colour is thinly overcoated. The method for investigating by the ultraviolet fluorescent reactions have also been operated, which proved that organic pigments are used there.

※14 The part of Brahmi script of the west wall of the 224th cave in Kizil
(infrared reflection photography)



Regarding the letters, according to Hirotoshi Ogihara (荻原裕敏), he illuminated that the language is Tocharian B.¹¹ It is the title of Buddha's painting written under the letters.

【Transcription/Chinese translation】

|| tane pañākte vaiśāline a [mp]·pa /// ||

|| 此處, (乃) 佛在吠舍釐.....///||

Thus, this part indicates the depiction of the Buddha that stayed in the ancient Vaishali (吠舍離) country was expressed in the corresponding portion of the mural paintings.

※15 The entire part of Brahmi script of the west wall of the 224th cave in Kizil (infrared reflection photography)

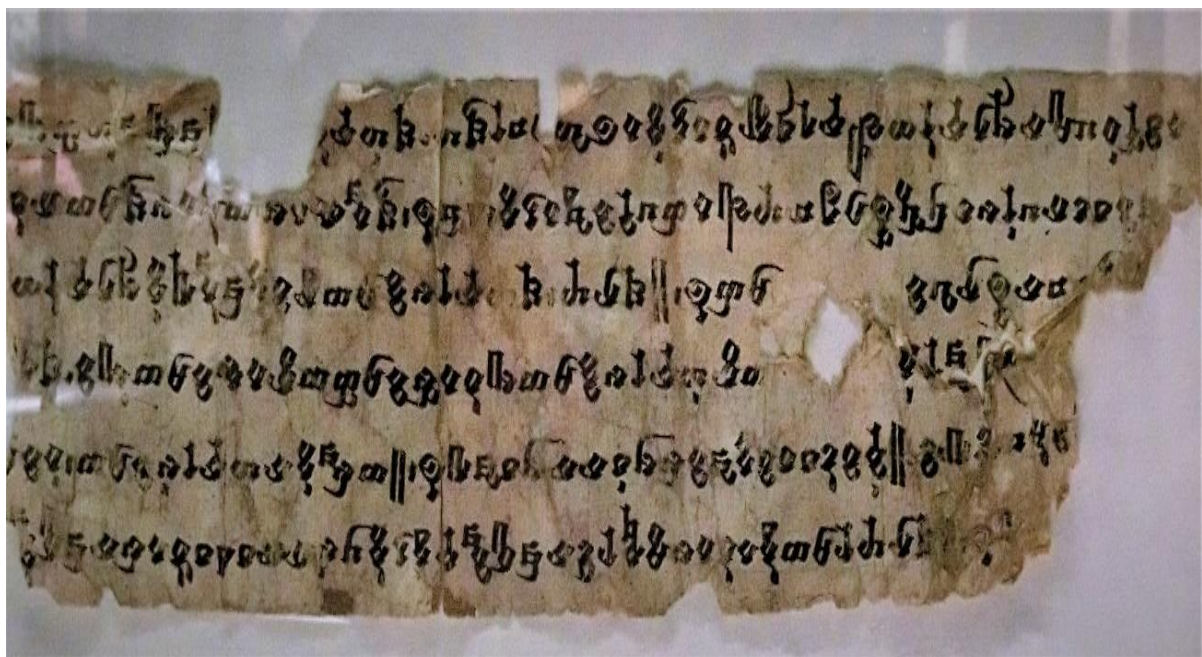


¹¹ Id.

The west wall of the 224th cave particularly has many defects, and its position restoration has been therefore considered difficult. Nakagawahara (中川原) of Nagoya University (名古屋大学) in Japan has dealt with this subject, and she tried to identify the position of missing murals based on the Le Cook's report, archive pictures of fragments stored in the Berlin-Asian Art Museum.¹² However, the topic of Tocharian B, which has appeared in this survey (Sato, 2012-2015), indicates what is drawn in the lower part of a new viewpoint by linguistics. After all, it turned out that the Tocharian title newly discovered in the west wall of the 224th cave suggested that a depiction should be about the Buddha in the ancient Vaishali country of Buddha.

※16 Brahmi script at the museum in Urumqi

When I contacted Sato and Hagiwara directly, they answered that they had incidentally met in Kucha but did not know their works mutually



¹² The report (Sato, 2016), 『キジル第二二四窟 (第三区マヤ窟) 主室壁画復元の試み』, pp. 54-69

although they surveyed in the same place and time. As noted in the introduction section, the discovery of title in Tocharian B was independently published in each academic discipline. There has been no challenge for restoration from this new comprehension of Tocharian title. I cannot wait for the new revelations.

2. 5. Date of the Kizil Grottoes

The next is about the date of the Kizil Grottoes.

Various discussions have been made on the timing of arrival of Buddhism in Kucha and around this area, which has been one of the big topics not only of research on the Kizil Grottoes but also on the Silk Road. Also, it is quite essential for the

※17 Brahmi script at the museum in Kucha



study of art techniques and painting materials since they are necessarily under the influence of the history of art techniques especially on the chemical for pigments. Therefore, I refer to explanation in detail of the time of arrival of Buddhism in Kucha and of opening the Kizil Grottoes.

The fact is, of course, that in research of caves, it is primarily important to chronologically address the problems to know the history as the foundation of research. However, in the case of study on the Kizil Grottoes, the note of the historical materials has not found. Namely, until today, no mention of historical inscription or chronology related to the creation of the caves has been found, and we hardly see a systematic approach to related information. Hence it is difficult to estimate the age and chronology of the caves accurately. However, in the opinion of most scholars, it is consistent that the Kizil Grottoes were built in the middle of the 3rd century to the 8th century or the 9th century, but there are still many opinions concerning this issue.

※18 The exhibition of the Kizil Grottoes Murals in Beijing



A thesis¹³ written by Su Bai (宿白), who passed away in Beijing in 2018, is an important precedent study for my work. He tried to specify the age by the chronological measurement technology using radioactive carbon C14 and summarised in his paper in 1983 (*Appendix III*). According to him, the following classification is made:

1st stage: 310 ± 80 (year) - 350 ± 60 (year)

2nd stage: 395 ± 65 (year) - 465 ± 65 (year), and to the early 6th century

3rd stage: 545 ± 75 (year) - 685 ± 65 (year), and since then

※19 The model of the 14th cave in Kizil at the exhibition of the Kizil Grottoes Murals in Beijing

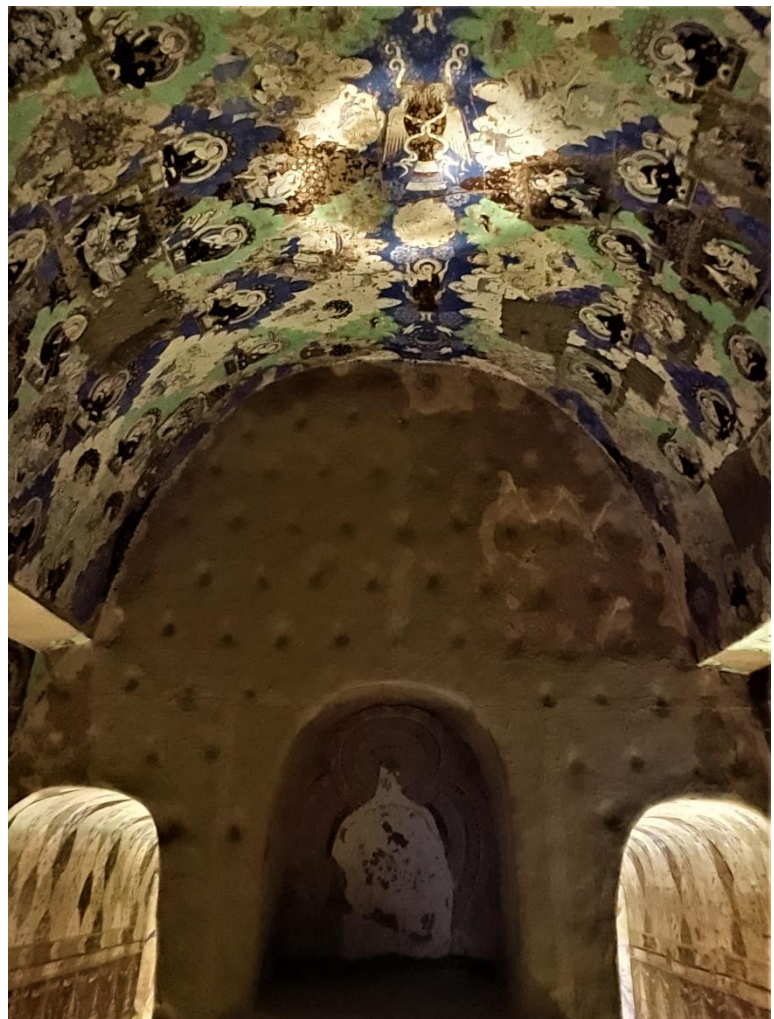


¹³ 新疆ウイグル自治区文物管理委员会他編,『中国石窟キジル石窟 第一巻』,1984,「キジル石窟の形式区分とその年代」,安田治樹訳,宿白,pp. 162-178

According to his report, of these three durations, the first and second stages are exactly the peak time of the Kizil Grottoes and this period can be thought between the late fourth century and the fifth century. Besides, before the first stage, it seems that there was an early stage for a while. Then, he added an early stage before the first stage, that is, there are four stages as (1) the initial stage, (2) the first stage, (3) the second stage, and (4) the third stage. On the other hand, during the last one, namely the third stage, the Kizil Grottoes gradually went into a decline. In the Kizil Grottoes, we can find the titles in Chinese were inscribed written by travellers in the north wall of the 105th cave main room in 726 and the altar of the north wall of the 220th cave in 764. From these titles, it can be known that in the early to the middle 8th century in the Kizil Grottoes, it was a situation where at least some caves had already fallen into disrepair.

※20 The mural inside the model of the 14th cave in Kizil at the exhibition of the Kizil Grottoes Murals in Beijing

Before the research of Su Bai by the Chinese side, from 1946 to 1947, the Korean Chinese painter, Han Leran (韩乐然) visited Kizil twice and copied the mural paintings, while during that time he tried to compare and analyse the record of the Kizil Grottoes Murals. Afterwards, the researches were conducted by Chang Shuhong



(常书鸿), who participated in the Xinjiang Culture Bureau Survey Team of the Northwest Culture Bureau in 1953, and by Yan Wenru(阎文儒), who joined the team combining the Xinjiang cave survey team of the Chinese Buddhist Association and the Dunhuang Cultural Research Institute in 1963. Their investigation covered caves in almost all areas in Xinjiang province, and they presented new views on the period of the Kizil Grottoes. Su Bai analysed these researches and, in comparison with German analyses, he claimed that both scholars were specialists and studied Dunhuang caves and other important caves to the east for many years. Thus, the surveys by the Chinese scholars were carried out based on their abundant experiences, and they must have a big difference of opinion with German researchers.

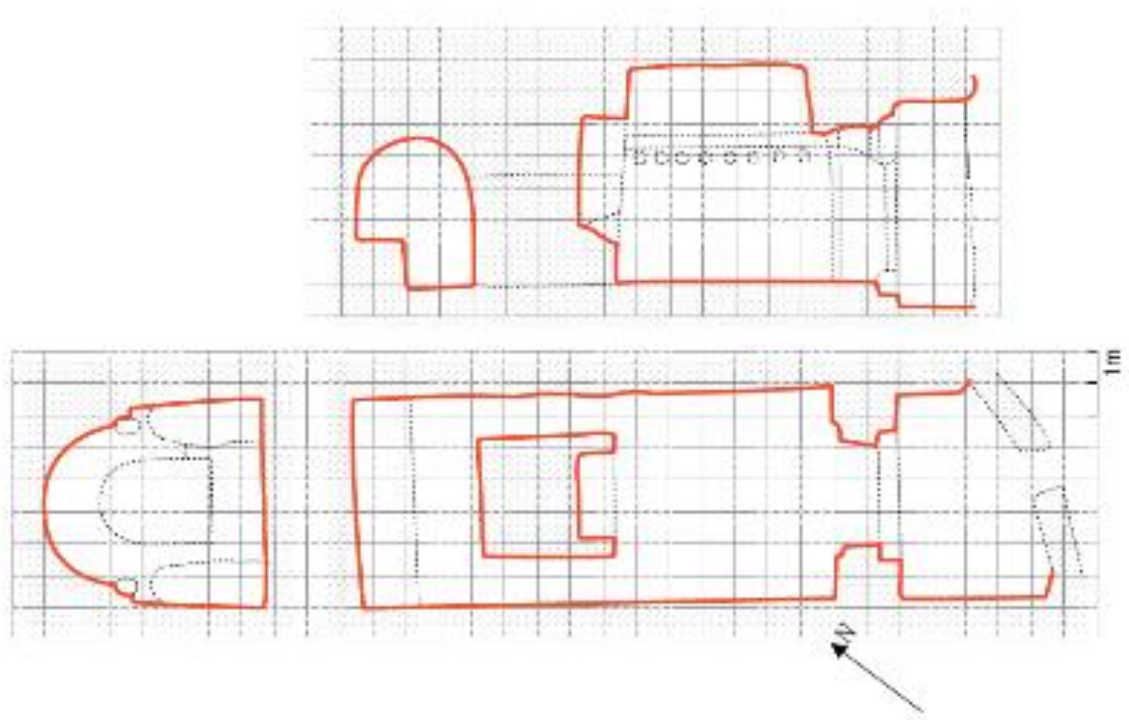
After that, under the assistance of the Chinese Government Cultural Affairs Bureau, the Cultural Bureau, and the Cultural Management Committee of the Xinjiang Uighur Autonomous Region, they made a research team by the Historic Cave Archeology Practice Team of Beijing University and the Kizil Cultural Protection Center in Baichen (拜城) County. They started an archaeological investigation of the Kizil Grottoes. They first proceeded with the excavation survey of the caves, while they carried out necessary studies on the classification of the cave and its transition in Qiuci area. The laboratory of the Historic Cave Archeology Practice Team of Beijing University, whose leader was Su Bai, was in charge of dating by radioactive carbon C14. As I already indicated above, the results coincident with Today's established views.

On the other hand, the European side has also continued to conduct research. They classified the murals into three groups in another way. Taniguchi (谷口) explained very carefully in the report (Sato, 2016)¹⁴ that, according to Waldschmidt, in (i) the first Indo-Iranian style, warm colours such as red, brown, and green are dominant, while its graded effect

¹⁴ The report (Sato, 2016), 谷口陽子, 『キジル千仏洞の壁画に関する彩色材料と技法調査：六九窟、一六七窟、二二四窟を中心に』, pp. 34-48

is not so noticeable. On the other hand, (ii) the second Indo-Iranian style has a strong shadow, which is relevant to so-called “Kakudori” (隈取), in the face and body, used lapis lazuli blue. The 224th cave of the Kizil Grottoes, which is dealt with in this paper, is considered built during this period. Finally, (iii) the third style is generally characterised as influencing the form of Chinese (the Tang dynasty) Buddhist art. As I mentioned, he classified in three ways by the form of murals. However, as Su Bai pointed out, this research lacked detailed consideration of the history of other Xinjiang areas, especially the historical background of Buddhism propagation. Also, it did not pay enough attention to the situation of some well-known caves in the east of Xinjiang. Furthermore, it is entirely different from the method of a survey conducted in by Chinese researchers. According to style classification by Waldschmidt, Kizil was categorised into three major styles, but it is from the viewpoint of the colour of the mural painting and colouring technique, not from the mural painting motif and knowledge on Buddhism, nor scientific way, which was different from the physical surveys by Su Bai (*Appendix II*).

※21 The elevation view and side view of the 224th cave in Kizil



※22 The isometric drawing of the 224th cave in Kizil

[illegible]

2. 6. The 224th Cave of the Kizil Grottoes Murals

Here, I describe the 224th cave of the Kizil Grottoes Murals that I deal with my thesis as the principal object. This 224th cave is one of the most noteworthy among all the Kizil Grottoes that number 349 caves in total. The most significant reason is the bright blue colour used there.

Below, I will deepen the knowledge of the 224th cave based on Nakagawahara's thesis¹⁵ on the theme of the restoration of central room mural painting of the 224th caves in this survey (*Appendix III*).

First, concerning the subject of the mural painting, this 224th cave exhibits the most mainstream cave structure of the Kucha area, that is, the central column style. The images of Kuyo (供養), which means the ceremony to pray for the repose of the dead, for Bhikkhu (比丘), Buddhist priests and the royal family, are drawn on the left and the right rear walls of the front room. These indicate that the 224th cave was built under the royal family's donation and support. Then, paying attention to the figure of this royal family drawing, there is a woman wearing the same hat as Svayamprabhā in the dominant figure drawn on the right side of the front wall of the main room in the 205th cave. Therefore, the relevance between the 224th cave and the 205th cave can be estimated. Moreover, the possibility of construction by the donation of the same person and the same group is assumed for both caves.

¹⁵ The report (Sato, 2016), 中川原育子, 『キジル第二二四窟（第三区マヤ窟）主室壁画復元の試み』, pp. 54-69

Another reason for the relevance of the 224th cave and the 205th cave can be that the structure and scale of the cave, the themes, and diagramming program of the Dharma teachings are similar. However, while they show high similarity in these ways when examined in more detail, there also appear some differences in colour tone, figure shaping, which makes the characteristics of the 224th cave much clearer than other caves. Specifically, in the previous studies in Japan, according to the thesis of Nakagawahara (2016), Kumagai (熊谷)¹⁶ and Ueno (上野)¹⁷ had illustrated the features of mural paintings of the 224th cave compared to the 205th cave.

The colours of the third district Maya cave (the 224th cave) is blue-grey, orange, pale ocher, white and much other colours used as standard colours, whose shading (Kumadori) is thin, and the drawing lines extend vividly and freely. Meanwhile, the colour of the second district Maya cave (the 205th cave) uses garish-hued blue, red-brown, also the expression of shading (Kumadori) is very brilliant, and the drawn lines are somehow awkward. (Kumagai, 1953) (Appendix IV)

¹⁶ 熊谷宣夫, 1953, 「キジル第三区摩耶堂将来の壁画—主として徒盧那像及び分舍利圖について—」, 『美術研究』, 第 172 号, pp.12-35

¹⁷ 1980, 上野アキ, 「キジル第三区マヤ洞壁画説法図 (上) —ル・コック収集西域壁画調査 (2) —」, 『美術研究』, 第 312 号, pp. 48-61

The common features of these pieces ([note by Ueno] the Kizil 224th cave) are that the beautiful blue colours are used everywhere. Moreover, there are many white margins with blue frames at the top or bottom, and that the drawn lines are very flexible, and shading (Kumadori) is also soft that can express persons with a relaxing look on their faces while the lines of the second district Maya cave are independent and strong, it is a point that it takes a mild expression of facial expressions without tightness of the chord.¹⁸ (Ueno, 1980)

(AppendixV)

※23 The woman wearing the same hat as Svayamprabhā of the 224th cave



¹⁸ 「キジル第三区マヤ洞壁画説法図（上）—ル・コック収集西域壁画調査（2）—」, 1980, 上野アキ, 『美術研究』第312号, pp. 48-61

Here, we should pay attention to Ueno's point of view focusing on the blue border lines above and below the white band sections. Because there are no other white margins bordered by pure brilliant blue lines, which could be seen elsewhere in the Kizil Grottoes, therefore, it is considered a key characteristic of the 224th cave in Kizil. As mentioned above, when comparing the two caves, it is presumed that the 224th cave should belong to the second style in the German classification based on the motif, its style, and the composition of the cave itself, but on the other hand from the viewpoint of technical material in colouring, it is unlikely

※24 Svayamprabhā of the 205th cave

that the same artists made the works in all caves.

Also, Nakagawahara mentioned the past research of Kitsudo (橘堂)¹⁹ and pointed out the relevance to the Western Turkic Khaganate (西突厥) from the hairstyle of the queue (辮子) person drawn in the mural.²⁰ Specifically, it is a queue person who has a conversation with other Qiuzi people seen in the front wall of the 224th cave behind the main room. That person wears his hair long behind the Qiuzi people who express their mourning



¹⁹ 橘堂晃一, 2011, 「西ウイグル国と仏教」『中央アジアにおける仏教と異宗教の交流』, 2010 年度第 2 回国内シンポジウムプロシーディングス、龍谷大学アジア文化センター

²⁰ The report (Sato, 2016), Nakagawahara, pp.56-59

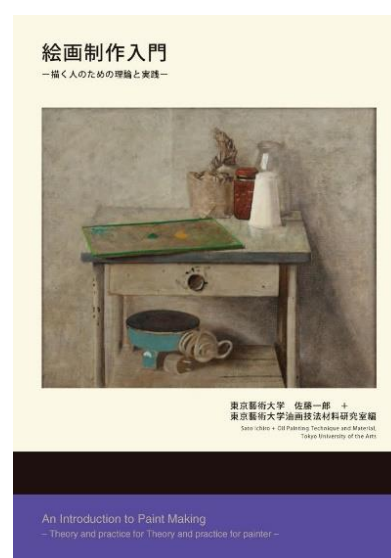
for some cremated bodies in the upper part of the mural. She found that the queue person gestures as hurting his own body and face to an act of mourning posthumous tribute to the dead and that its manners characteristic can be thought to be a custom peculiar to the nomadic tribes. Thus, she guessed that he should be influenced by the nomad people, especially Western Turkic Khaganate, and the queue person represented the Western Turkic Khaganate people. Indeed, this 224th cave looks more luxurious with enough lapis lazuli and gold foils compared to other cave paintings, and she related this reason to the Western Turkic Khaganate dominance.

3.THEORETICAL ASPECTS OF MURAL ART

In this chapter, I turn my attention to practical art and focus on art techniques and painting materials since I think that it is necessary to explain the art theories that was the basis for researching and analysing the blue colour of lapis lazuli in the Kizil Grottoes. In particular, art techniques and painting materials such as pigments have evolved with the development of chemistry. Therefore, it is fascinating in terms of chemical history to investigate the pigment used in the Kizil Grottoes Murals drawn in the past (especially from the 3rd century to the 8th or 9th century) with the current technology of the 21st century. Hence, I also mention the results of scientific research in Chapter 5, <5. 4. Chemical Investigation on Lapis Lazuli>.

This section is based on the descriptions of the text book of Tokyo University of the Arts.²¹

※25 “Oil Painting Technique and Material”



²¹ Sato, 2014, especially chapter. 1 「絵画学の基本」, pp.1-64 and chapter 2 「顔料と媒剤」, pp.65-94, and chapter 4 「画家の絵画技法」, pp. 105-124

3. 1. What is <Learning Painting>? (Leonardo da Vinci)

Here, based on the theory illuminated in the textbook (Sato, 2014) of Tokyo University of the Arts, I would like to consider a fundamental question of whether <painting> can be a subject of research by scholars or not. Although it would be perhaps a very extreme opinion, the issue can be asked as “Is the artist <learning painting> is the skill of craftsmen's work where their hand just moves on the canvas?” As one of the answers to this problem, there is the masterpiece of Leonardo da Vinci as a person who formalised <painting> as academia, and he answered in his book “painting theory” with the proposition “Can painting be regarded as an academic subject or not?”

"Painting lives in the minds of the audiences who contemplate the art; however, they cannot reach completion without waiting for the hand operation. As for the paintings, as for academic and self-evident principles, the issues are what is a solid that makes shadows, then, what is the primary shadow, the secondary shadow, what is the brightness, that is, darkness, light, color, then furthermore solid, shape, position, far, near, dynamic and static. These things are understood by the brain without operating the hands, and this is the painting studies that can be contemplated in the audiences' brain. Thus, from then on, more sophisticated production can be begun than the observation above and study." (**Appendix VI**)

In this manner, he saw painting as qualified for academia and places it at the top of all studies. Then, he found the major premise in the act of “production” which requires hand operation in the other academic fields.

3. 2. Basic Theory of Art Techniques and Painting Materials (“Painting”)

Here, it is an ambitious topic, but I wonder how the painting works as fine arts? I think that this question resonates with another question as to what the fine arts is, therefore I feel, it is challenging to address the single right solution. However, at least, the painters find their interpretation of the question, for example, in a textbook (Sato, 2014) compiled by the Oil Painting-Technique and Material Department (技法材料研究室) of Tokyo University of the Arts in Japan, which is the highest academic institute for the arts in Japan. It states the premise of the painting as “<Painting> is established through the act of <observing> and <drawing>” (*Appendix VII*), then it describes the painting theory as “painting materials and art techniques are necessary to realise those actions”, from the viewpoint of the technical material laboratory.

The responsible author of this textbook was a professor Ichiro Sato, a professor at the Oil Painting-Technique and Material Department of Tokyo University of the Arts in Japan. He is, in fact, also the general manager of the Kizil Grottoes Murals survey dealt with in this paper. In other words, by first considering painting theory based on the text (Sato, 2014) of Tokyo University of the Arts, it is an attempt to understand the painting theory which was the premise of the Kizil Grottoes Murals survey. Moreover, that is, his most important thought is merely the importance of art technique and painting materials once it is stated, and from that point, this textbook is basically written and also investigating the Grottoes.

3. 3. Basic Theory of Art Techniques and Painting Materials (“Painting Materials”)

The following question is what the <painting materials> is. To come right to the point, it is the mixture consisted of pigment and vehicle, and the lapis lazuli I have mentioned above corresponds to pigment. Thus, painting is primarily made by powder which effects chromogenic, and a medium which plays a role of adhering on the support surface such as a wooden board (panel) and a hemp cloth (canvas). Thus, the painting materials are made with pigment combined to a vehicle to knead or paste on the support. In the case of the mural paintings in the thesis, the pigments are such as lapis lazuli, and soils and rocks while the rock surface inside the caves where the picture is written are the support (*Appendix VIII*).

Regarding the pigment, the most accessible one from ancient times is soil such as yellow soil (yellow ocher), red soil (bole), green soil (Terre Verte). Namely, in ancient times these soils were used as pigments. After that, in Egypt, Greece, and Rome, they crushed the stones into a fine powder, and they made pigments from various kinds of rocks such as cinnabar mercury, lapis lazuli, azurite, malachite. Therefore, the pigments used in the Kizil Grottoes Murals are roughly derived from soil and rock. Then, in the 13th and 14th centuries of the Middle Ages, as alchemy developed and trade advanced, various pigments became available. As chemistry evolved in the 18th and 19th century, synthetic inorganic pigments such as Prussian blue, cobalt blue (Blue), cadmium yellow, chrome yellow were developed one after another, and painter had more choice for colours with more reasonable price than ever. In the 20th century, synthetic organic pigments were invented, such as azo-pigments, quinacridone-pigments for red colours and Phthalocyanine-pigments for blue and green.

3. 4. Multi-Layer Structure of Painting Materials (“Art Techniques”)

Before describing the painting theory, what I would like to confirm is that oil paintings are never completed by just putting coloured pigments on the canvas with a paintbrush or a painting knife. Especially for those with poor experience drawing art or not interested in art, I guess it should be the typical image of <drawing a picture> that paints on a pure white canvas with a brush or a painting knife from a wooden palette. At least, I had that impression until I drew oil painting for the first time. Furthermore, I think many people in Japan have the image that the art should be intuitive and drawn or painted unplanned because the artist Taro Okamoto (岡本太郎), who made the “Tower of the Sun” 《太陽の塔》 at the Osaka Expo in 1970 left a remark that “Art is Explosive! (「芸術は爆発だ！」)” in the television commercials. The textbook of Tokyo University of the Arts also points out that “In the contemporary period, fewer people have enough knowledge of painting materials and art techniques, especially about oil paintings, there is a huge misunderstanding that oil paintings should just be slathered on enough oil paint”.

“Painting” is a crystallisation of the painting materials and art techniques that the painters draw a picture intentionally utilising the complex mechanism of the oil painting, and that there is a historical legacy in the tradition of the tempera paintings. Specifically, that is the intricate contraption of the picture in oils. We can recognise the difference of the colour in the presence of refractive index drawn by pigment and vehicle on the screen painted with oil painting, where the incident light hits, irrespective of whether it is on a canvas or a mural of a rock wall. Some kinds of light rays are reflected on the surface of the screen, while other rays are transparent to the paint layer and others are indicated on the surface of the ground paint. Thus, there are various optical phenomena such as diffuse reflection, specular reflection, partial absorption and reflection of incident light there, how to make use of that mechanism, which is so to speak, a work of the artist for colours.

For example, we can take “The Ghent Altarpiece” of Jan van Eyck as an analogy of the masterpiece of the best painting techniques on oil painting. Although this work may be generally known to be the first oil painting in the art history, after the investigation into this carried out in the latter half of 1970, it was found that Jan Van Eyck widely used aqueous, emulsion, an oil-based mix and that he commanded a composition technique by using different painting layers separately. Turning to the blue colour, which attracts attention in this paper, we can see that Virgin Mary’s outer clothes are coloured in blue. This blue was drawn by the lower layer drawing, where lead white and azurite are mixed, and an iron oxide-based red pigment is also added. Then the artist tried to model the garment expressed merely by the mixture ratio of azurite and lead white. After this underdrawing, delicate expressions and features such as gloss, the texture of the skin, wrinkles of clothes, highlights and so on are drawn, and finally, the top layer is permeated with only pure lapis lazuli. Thus, in the works of Jan van Eyck, we can often witness that lapis lazuli is combined with an aqueous medium, and most of them are used only for the uppermost permeate layer.

※26 “The Ghent Altarpiece”



Painting materials such as pigments have evolved dramatically with the development of science and technology in chemistry and physics. Particularly the oil painting technique that the brothers Hubert and Jan van Eyck produced in early Netherland in the 15th century and the diversification of the number of colours by synthetic inorganic pigment due to the development of chemical technology in the 19th century could be called “revolution”. The history of these basic art techniques and painting materials is, of course, also applied to the painting materials of paintings in the Kizil Grottoes.

Perhaps the transition from the tempera paintings to the oil paintings by the van Eyck brothers may be simply that oils replaced eggs as the binding material. However, it is too simplistic to conclude like that. Because, for example, as can be seen in “The Ghent Altarpiece”, the painting is sequentially drawn by a variety of medicines such as glue, eggs, drying oil, and resin. Also, we can find that when observing the cross section that the painting layers have a multilayer structure. Namely, there are opaque watercolours in the lower layer and then transparent oil paint in the upper layer, and tempera paintings of the egg in the middle.

※27 The part of the Virgin Mary of “The Ghent Altarpiece”

The painting method is the same as the Kizil Grottoes Murals thematised in this paper, although there is a difference of the support between the wooden board and the rock skin, in that the support is pricked up and then paint on it. Unlike paintings drawn on woodblock prints and canvases, however, the Kizil Grottoes Murals has a simpler structure since the mural paintings depicted inside the caves and since drawn on more brittle support in the broader area.



3. 5. Purpose of the Multi-Layer Structure

Next, I would like to pay attention to why past artists adopted such a multi-layered structure to draw a picture. That is, its intention and purpose because this point is an essential viewpoint of expressing religious motifs of Buddhism that the worldview that the Kizil Grottoes was about to represent.

To tell the conclusion first, the method of overlaying with both painting materials such as opaque and transparent colours is one of the painting techniques of how to express the solid in a plane. In other words, it is an answer for how to replace the world that includes the visible three-dimensional and the space sensed by the human eyes with the flat surfaces of the screen as it is, and how to reproduce the world captured by human vision with painting materials on a flat. Especially before the Van Eyck brothers, religious paintings had been mainstream in the arts. However, with the appearance of oil painting techniques, it became possible to target the real world in addition to religious motifs. In other words, we could reproduce the vision in the world as reflected in the mirror as a substance is to express the real world. Thus, the artists were trying to unite the representation of the ordinary visual world and the sacred realm of the gods by painting.

To return to the main topic of the thesis, when we pay attention to the subject drawn in the Kizil Grottoes, for example, the themes of the 224th cave were both the image of the ceremony to pray for the repose of the dead of the Buddhist priests (比丘供養図) and the royal family (王侯供養図). In other words, the themes were both Buddhist motif and a real world. Furthermore, these murals are also drawn in a multi-layered structure with similar uses as the van Eyck brothers. As mentioned above, we can see in the Kizil Grottoes Murals a standard item in terms of their multi-layered structure in the history of technique materials.

4. TECHNICAL ASPECTS OF MURAL ART

In this chapter, I focus on the lapis lazuli's blue colour used in the 224th cave in Kizil, based on the knowledge that I have dealt with in the previous chapters. Here, I will use the method of fine arts and explain in the technical aspects.

There have been decidedly fewer surveys or prior researches on practical painters' perspectives from fine art until now, and particularly studies focusing on the blue colour of lapis lazuli have been inadequate. Hence, I will practice it myself this time.

4. 1. Three Chinese Characters for “Blue”: 青, 碧, 蒼(《Almost Transparent Blue》)

※28 Seaport in the Goto Islands, Nagasaki, Japan



The Japanese language uses various kanjis 《漢字》 (Chinese characters) when expressing the colour of blue. When I visited Kucha and saw the blueness of the Kizil Grottoes, I thought which Kanji for blueness was appropriate.

About the topic of blue colour, when I turn to the East, I feel that there is a tendency for blue to seek its nature of permeability even in Japan with my nationality. For example, in the case of a clear sky with no clouds, the expression “Nukeruyōna Aozora” 《抜けるような青空》, which means “penetrating clear blue sky”, is used. However, in this case, “Nukeruyōna” means that there is no obstacle and it is heading to the sky far away as we can reach to the universe. In addition to this, there is in Japan a novel called “Almost Transparent Blue” 《限りなく透明に近いブルー》 written by Ryu Murakami (村上龍), who had won the Akutagawa Award in Literature for this work in 1976. I feel that this is referring to blue transparency, as well.

Next, I turn our gaze toward Chinese characters which express the blue colour. There are several of them, that is, 《青》, 《蒼》, 《碧》.²² Chinese characters are ideograms. Therefore, the blueness suggested by each Chinese character is inherently different.

First of all, the most common “blue” by Chinese character should be 《青》, which I think is the most suited to express the blueness of lapis lazuli since the other two characters intrinsically imply green or grey. Furthermore, in Japan, this 《青》 is the only commonly used Kanji in contemporary, which is practically used as names of all types of blueness in English. For example, the blue of sky and sea in the summer days is usually expressed as 《青》. I think

²² The Chinese language uses 《藍 (色) lan2 (se4)》 for the blue colour, but I make no reference to it since in Japanese there are a difference in nuance between 《藍》 and other Chinese characters (青、碧、蒼). Besides, the sound of characters is also different: 藍 is “ai” while other characters are “ao” in Japanese.

that this expression of 《青》 for blueness relies on the sensuous of the Japanese. There is a certain number of exceptions in Japanese, for instance, the “blue” of the blue light (青信号) of the traffic light and “blue” of the leaf (青葉) represent green colour, which coincides with usage in Chinese blue. It is because the Chinese character of “blue” also expresses a fresh green colour such as a green vegetable (青菜 qingcai) or green grass (青草 qingcao) in Chinese.

However, when expressing blue that highlighted green with a Chinese character, 《碧》 can be used for it. This blue is, for example, the blue of the Jasper, which is coloured more in green than in blue, while it is not a perfect green colour but instead refers to a greenish blue colour. In sumo wrestling in Japan, for example, there was a Sumo wrestler from Bulgaria called “Aoiyama” 《碧山》. The character of his name “Aoi” 《碧》 was named in honour of the ocean of his Wakayama (和歌山) by his master (師匠), and in this case, his master tried to express “the beauty of the sea” unlike the blue colour by 《青》 described above, but describe the blue colour of the green of his hometown Wakayama. In other cases, the lyric of Yumi Arai's song “Close Your Eyes” 《瞳を閉じて》 also expresses the beauty of the sea with the character 《碧》 (*Appendix IX*). The motif of this blue sea was the ocean of the Goto Islands (五島列島) of Nagasaki Prefecture (長崎県), and when I visited and saw in my eyes, I could find it is more 《碧》 rather than 《青》 since the sand of the seafloor reflected the sun's light.

The final “blue” is 《蒼》, which usually used in Japan for expression of a dense and dark forest such as 《鬱蒼》, and in this respect, it is the green colour of the plant. However, as the word of “sōhaku” 《蒼白》 that means bluish white implies, it sometimes refers to a blue colour similar to a slight dull grey. As an image, it should be the cold sea in with poor weather in winter. For example, in Sumo wrestling in Japan, there was a Sumo wrestler called “Sōkokurai” 《蒼国来》 from the Inner Mongolian Autonomous Region of China. His name means the person who came from the blue country and the origin of his is from the grassland

of Mongolian.

As already stated above, the best way to express the general blueness of lapis lazuli in Kanji may be 《青》. However, I also felt that the blueness of lapis lazuli in Kizil that I saw locally includes 《碧》 because I thought that I could not find any greenness in the ground of Kizil surrounded by reddish-brown and blue sky and because lapis lazuli in Kizil also fills the role of greenness. On the other hand, it may be said that the dull blue colour of lapis lazuli is expressed by 《蒼》.

4. 2. Lapis Lazuli of the 224th Cave

One of the prominent features of the 224th cave is the use of lapis lazuli as a pigment because the 224th cave uses the blue of high purity lapis lazuli, and gold leaf or metal foil that its majesty is not seen in other Kizil Grottoes.

Murofushi (室伏)²³ refers to the use of lapis lazuli as a pigment as a significant feature of the 224th cave. Since the 224th cave uses high purity lapis lazuli's blue, gold leaf or metal foil and its majesty is not seen in other caves in Kizil. However, the trend of similar material usages is seen in the mural paintings of the 13th, 38th, 69th, 171st, and 205th caves in Kizil. Furthermore, they have in common that the four caves have the same motif (the image of Kuyo (供養) of the royal family) except the 38th cave (the image of Kuyo of the kneeling down secular figure) and the 13th cave (the image of Kuyo of the dead of the Buddhist priests). On the other hand, the use of gold leaf is seen in the Buddhist Preaching in the central room

²³ Sato, 2016, 室伏麻衣, 『キジル千仏洞における壁画の描画技法と材料について』, pp. 49-53

sidewall and the altar of the main wall. However, only in the 224th cave, we can see lapis lazuli's blue shine, gold leaf and metal foil used every part of the cave not only in the main room but also on the side wall, the front wall, the front wall, the ceiling, the side corridor. Unfortunately, the gold leaf and metal foil have peeled off, but from the viewpoint of the painting materials, the 224th cave still presents a truly synergistic bright and luxurious sight. This blue colour itself can be pointed as one of the main images symbolising not only the Kizil Grottoes but also the other cave paintings spreading in eastern Turkistan, in addition to Afghanistan and the Dunhuang cave group. Lapis lazuli has been widely used around the world for precious pigments, and the blue also attracted people throughout the ages.

Now, I will deal with the question of the blue colour.

Regarding the blue of lapis lazuli in Kizil Grottoes, based on what kind of art technique and painting materials are present, do we feel its beauty? It may lead to a sort of aporia if we try to logically understand the feeling that the blue colour of lapis lazuli, which has been considered commonplace, is "beautiful." Namely, the aesthetic sensibility, however in response to that question, I refer to the idea of the colour of blue, and its traditional refining method used by around the time of the Kizil Grottoes, and next examine the chemical result obtained in this survey.

4. 3. Purification of Lapis Lazuli

Nowadays, pigments are displayed in tubes at stationer's shops. Therefore, it is often

the case that even art college students who paint do not know about the purification of paint. Also, some students, for that reason, misunderstand that it has been effortless to purchase the pigments with standardised quality and colour since ancient times.

As I mentioned earlier, the history of lapis lazuli as a pigment, also called “ultramarine”, is very long. Also, its purification method is an essential technique for artists from the historical point of view, and we can find one of the oldest reference to it in the 15th century, Cennino Cennini, “The Book of the Art” 《Il Libro dell'Arte》.

In terms of refining methods of lapis lazuli, it is not necessary I think to refer too carefully to purification ways in this paper, but from the viewpoint of art techniques and painting materials, it would be quite important since the refining method is also related to the lapis lazuli used in Kizil Grottoes. Thus, I will point out some of the matters where we should keep in mind when I describe the murals of Kizil.

First of all, it is interesting that the refining method of natural lapis lazuli has not changed from the time of Cennino Cennini. From 2003 to 2010, under the guidance of Associate Professor Hiroshi Onishi (大西博), who belonged to the Oil Painting Technical Materials Laboratory of the Tokyo University of the Arts, conducted the practical lessons of extraction method of natural ultramarine pigment by the Cennini method, that is, the most classic purification way (*Appendix X*). The explanation of the process of how to extract the pure lapis lazuli from the stone written in the 15th century is briefly described that “It is a method of extracting impurities by kneading crushed rough stone with resin and then kneading with alkaline lye. The most brilliant blue pigment covered by resin can be extracted in the first stage of this method, and the level of blue intensity is dropping according to the times of

purification, and the blue saturation is up to the duration of working time.”²⁴ As a word derived from the Han Dynasty in China, it is exactly “Easier said than done” 《言之易而行之难》. This purification of lapis lazuli, therefore, requires a very long time and great care. The main point of this process is how to remove impure substance such as white and golden matters from the stone, and led to the deep transparent blue colour. However, lapis lazuli was particularly valuable because the proportion of pure blue that can be taken out with current techniques and equipment such as crushers and electric heaters is just a few per cent of the raw ore. When we look back at the point of view of this technical material, therefore, we can figure out how the 224th cave in Kizil, where lapis lazuli is used to paint on the entire surface, was once again solemn and magnificent. Additionally, I was surprised that it was refined and used in the eastern Turkestan surrounded by dessert with no electrical equipment at the time, which is much more troublesome and time-consuming.

Next, the critical point from this purification method is that the accuracy of the blue colour depends on the progress of refining operation. That is, the colour and the number of pigments that can be extracted from the stone can change according to the difference in the quality of the raw ore and the skills of purification of lapis lazuli by extractors such as kneading the material, adjustment of the lye, and working time. That is, these factors lead to the accuracy of the blue colour of lapis lazuli. According to the textbook of the Tokyo University of the Arts, the elutriation can be staged in 16 groups: the pigment is divided into squeezed stages (1 to 4 steps) and particle sizes (4 stages), whereby 16 types of pigment can be made based on squeezed steps and particle sizes. Then, they completed the purification of natural ultramarine pigments in 16 stages.

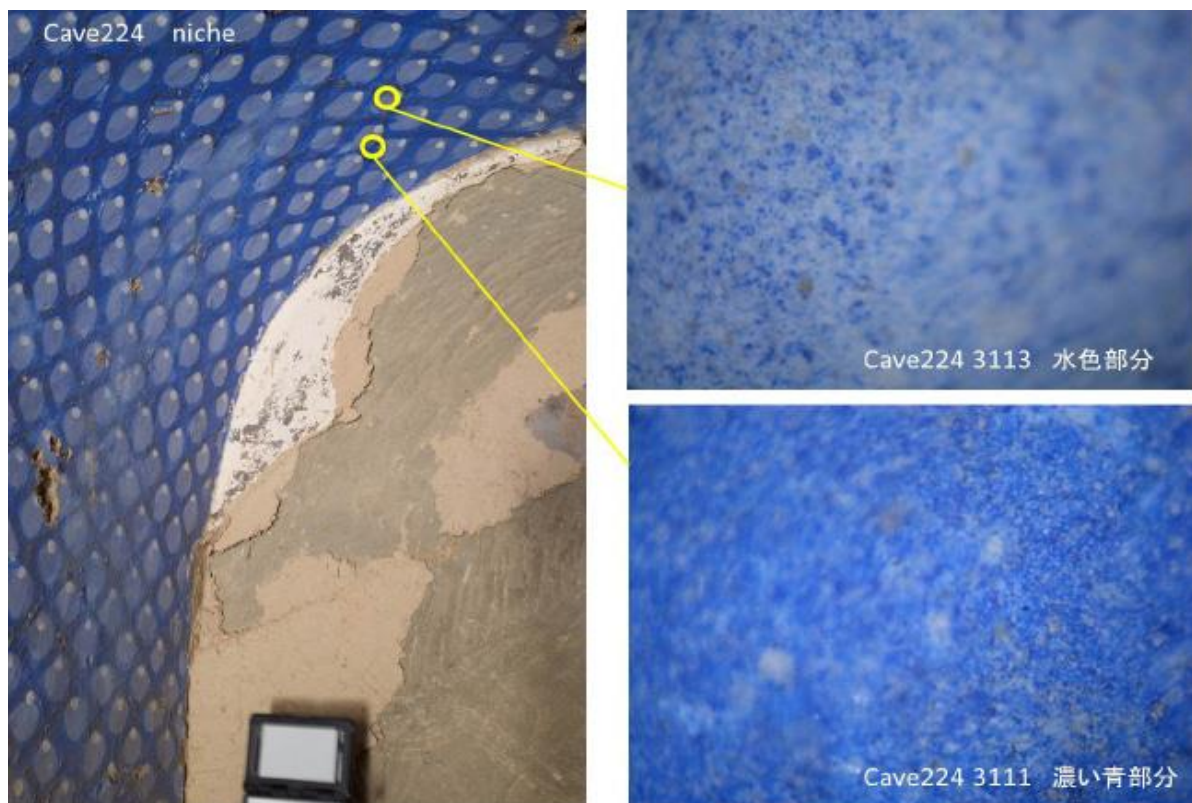
²⁴ 2014, Sato, 「チェンニーノ・チェンニーニ法によるラピス・ラズリ精製法」, p.169

4. 4. Blue Combination of Lapis Lazuli

Next, I change my view and look at a scientific investigation since a new X-ray data and chemical data were obtained in this latest study on the accuracy of lapis lazuli of the 224th cave. In the report (Sato, 2016), Michiko Sato (佐藤道子) pointed out the layout of the blues colour, but she did not use scientific methods but observed them by her eyes with the colour cards based on PCCS (Practical Colour Co-ordinate System).²⁵

First, I focus on how the pigment is applied observed in the microscope. The painting of Buddha altar of the main house of the 224th cave divided into a light blue part and a thick bright blue part as stereoscopic microphotograph, which is derived from the difference in the distribution of pigment. Also, the difference in the distribution of this pigment can be said the difference in purity of purified lapis

※29 Comparison of the blueness of the 224th cave



²⁵ Sato, 2016, 佐藤道子, 『キジル壁画の色彩調査と絵画的考察 キジル二四窟をおもに』, pp.24-33

lazuli as it is. In other words, the portion where the lapis lazuli pigment is densely applied appears dark, whereas when the pigments are separated one by one, it seems thin.

Specifically, the part of high purity and saturation of lapis lazuli can be seen in the sacred parts such as the head part of the Buddha and the most top sky part of the ceiling. On the other hand, the lapis lazuli of slightly less accuracy is used for the background, and animals such as deer and birds are using lapis lazuli which is greyish one with low quality. In this way, the colour combination of lapis lazuli is considered in a calculated way.

4. 5. Chemical Investigation on Lapis Lazuli

Strictly speaking, it can be said that lapis lazuli is kind of rock rather than a mineral because lapis lazuli's indigo part consists of one or several collections of minerals lumped together as a sodalite family as shown in the table. That is why purification is necessary as mentioned above, otherwise other white, golden impurities would be mixed. The gold colour is derived from pyrite, whose chemical formula is FeS_2 . It is a sulfide mineral. Whereas, the white colour derives from calcite (CaCO_3), that is, the carbonate of calcium. In detail concerning the blue colour, among the plurality of minerals, it is a sodalite mineral group such as lazurite, sodalite, hauyne, and noselite²⁶, which forms a polycrystalline body of the isomorphism.

²⁶ Sodalite: $\text{Na}_8 \text{Cl}_2 (\text{Al}_6 \text{Si}_6 \text{O}_{24})$; Nosean: $\text{Na}_8 \text{SO}_4 (\text{Al}_6 \text{Si}_6 \text{O}_{24})$; Hauyne: $(\text{Na}, \text{Ca})_{4-8} (\text{SO}_4, \text{S})_{1-2} (\text{Al}_6 \text{Si}_6 \text{O}_{24})$; Lazurite: $(\text{Na}, \text{Ca})_8 (\text{S}, \text{SO}_4, \text{Cl})_2 (\text{Al}_6 \text{Si}_6 \text{O}_{24})$

As described above, lapis lazuli exists in the natural environment with blue, white and gold colour mixed. It is often dotted with pyrite shining white and gold, which matched in harmony with indigo-blue ground colour. Then, when it is used as gemstones rather than as pigment materials, it is regarded as jewels, and it is excellent value as it is. On the other hand, white spots of calcite are often mixed, and in this case, the value as jewellery becomes low. When used as a pigment in paintings, they both white and gold elements are regarded as impurities that hinder high purity blue colour (*Appendix XI*).²⁷

※30 the ceiling of the 224th cave in Kizil (Xc)

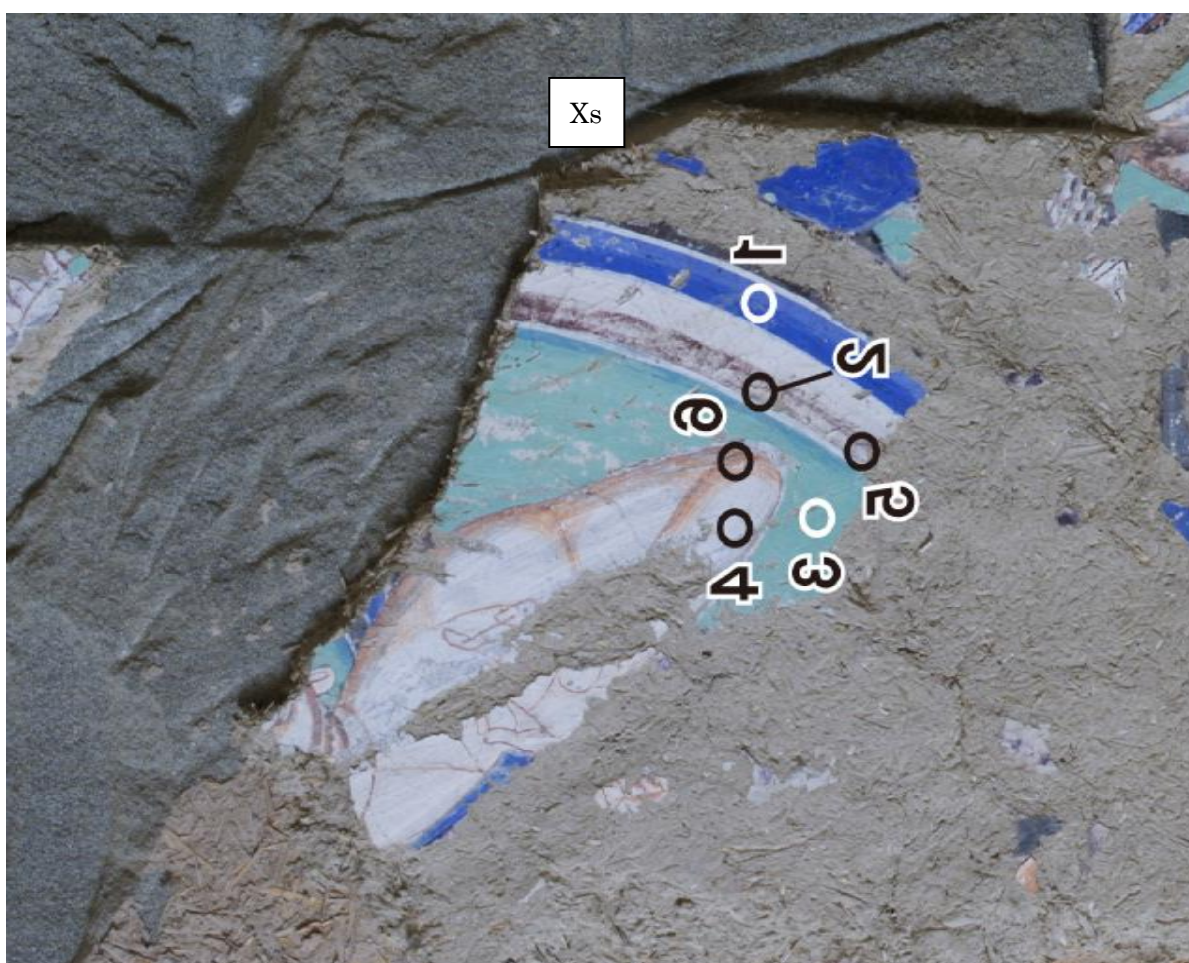


²⁷ 白水春雄. 青木義和, 1989

When analysed from a chemical point of view, the highly accurate lapis lazuli used for the central part has a higher proportion of calcium to iron. It is derived from the iron in pyrite in the lapis lazuli pigment. Hence, the level of iron is considered to indicate an abundance of impurities. That is, the pigment having a low level of iron has higher accuracy as blue. It is clearly shown that the ratio of iron is different when examining samples of the blue part of the paintings.

In this way, it became possible to visualise how much impurities were contained from the elemental composition of the chemical analysis and quantify the saturation of the lapis lazuli, which it had been only possible to distinguish with our naked eyes based on PCCS (Practical Colour Co-ordinate System) .

※31 the south wall of the 224th cave in Kizil (Xs)



Xc14-m: Ca950 Fe600

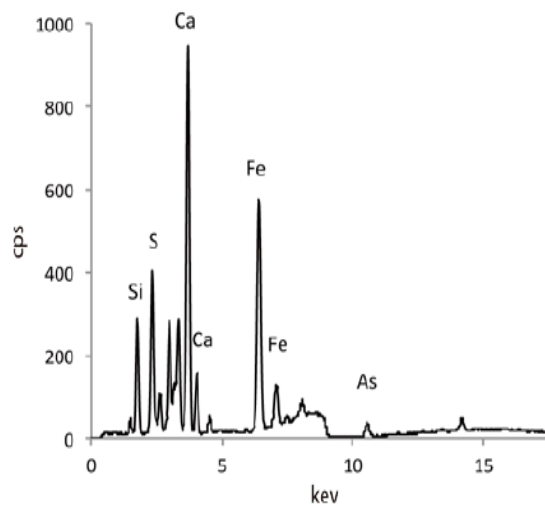
Xc14-s: Ca800 Fe450

Xs1-m: Ca1000 Fe 200

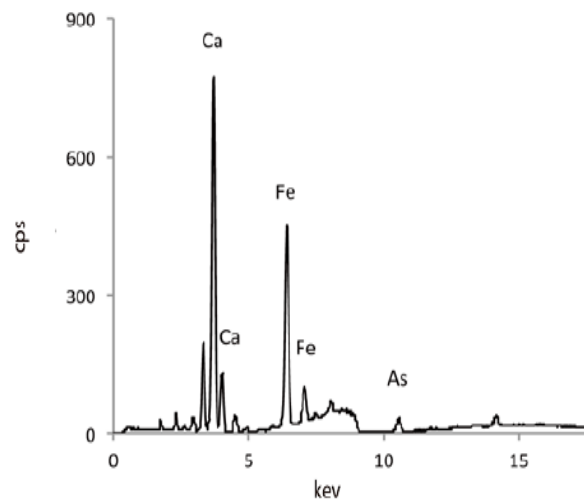
Xs1-s: Ca1100 Fe 300

Xs: the upper part of the eastern side of South wall of the 224th cave in Kizil

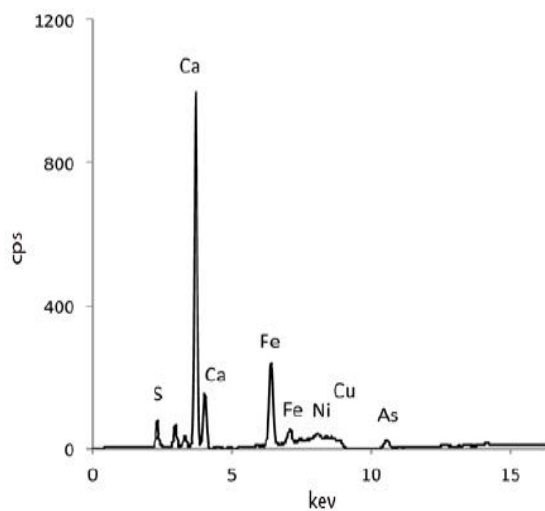
Xc: the ceiling part of the east side of the main wall of the 224th cave in Kizil



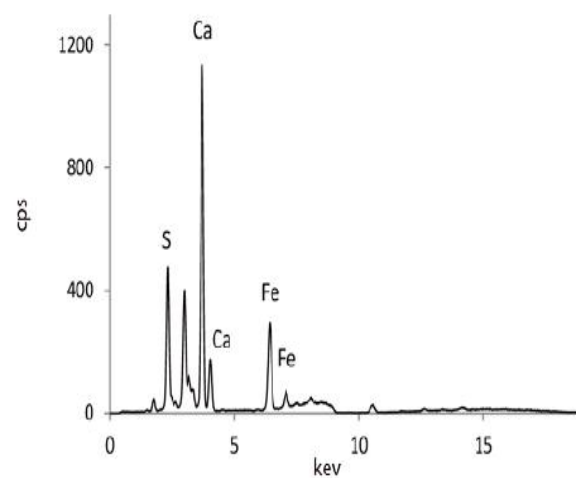
Xc14-m(1928)



Xc14-s(1927)



Xs1-m(877)



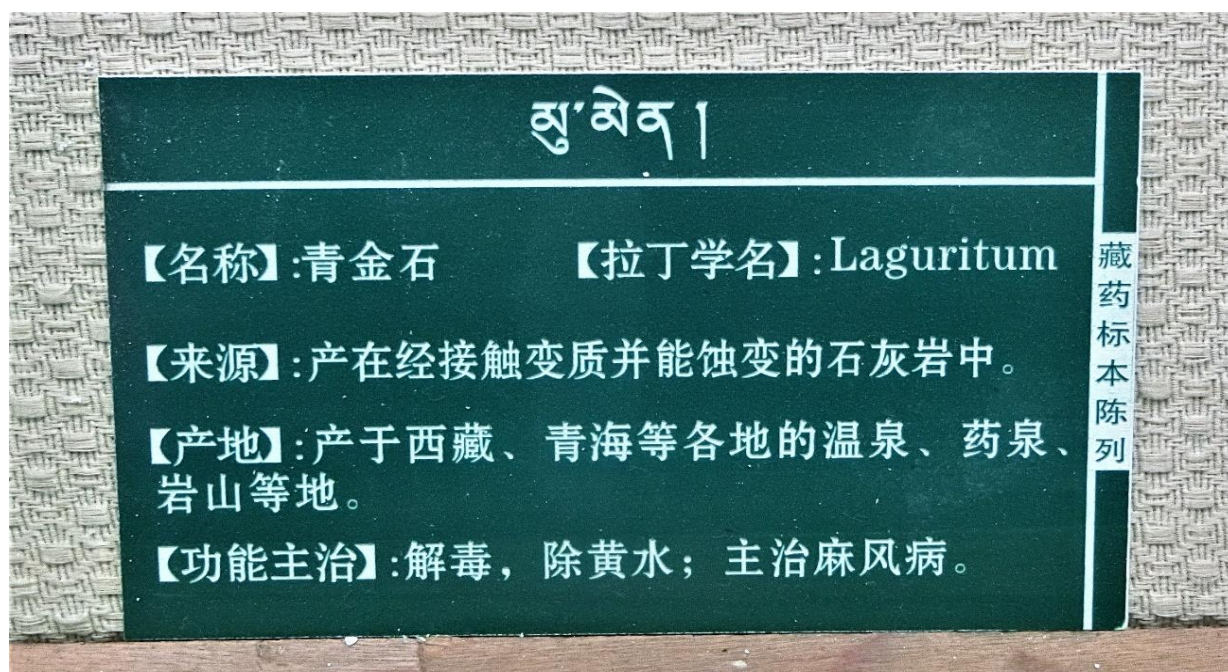
Xs1-s(876)

4. 6. History of Lapis Lazuli

According to the textbook (Sato, 2014) of Tokyo University of the Arts, lapis lazuli is a kind of gemstones called lazurite (ラズライト), ultramarine (ウルトラマリン), Gunjo (群青) in Japanese. Natural ultramarine used for pigment is made of crushed lapis lazuli, which is imported mainly from the mountain in Afghanistan in modern times. According to the textbook²⁸, The history of lapis lazuli is so long, in ancient times, it was known from the ancient Egyptian era, and its use as a pigment is found in paintings of the Buddhist monuments at Bamiyan in Afghanistan in the 6th and 7th centuries. There is a mineral deposit of lapis lazuli in the suburbs near Bamiyan and Afghanistan is still a major production centre of lapis lazuli.

However, I had a big question here. It has been believed that lapis lazuli comes from Afghanistan, but I would like to challenge this accepted notion. Why was lapis lazuli used abundantly enough only in the 224th cave in Kizil?

※32 Explanation of lapis lazuli displayed at the museum in Qinghai



²⁸ Sato, 2014, pp. 3, 18-19, 69-72, 108-109, 112, 170, 232, 243

To come right to the point, in my opinion, lapis lazuli was not only from Afghanistan but also from a closer place. Moreover, I have a hypothesis that it is temporary and the time was precisely the same as the time when the 224th cave was made. One of the grounds is the existence of the Tibetan-derived lapis lazuli seen in the museum of Qinghai. The photograph was an exhibition of lapis lazuli taken at the museum, and according to this, the production area was described as a hot spring, and rocky mountain in Tibet and Qinghai. It was not Afghanistan.

However, on the other hand, when I visited some jewellery stores that sold lapis lazuli as accessories in Kucha, they told me that all lapis lazuli sold there was from Afghanistan. Also, I received an answer that all lapis lazuli in the Kizil Grottoes came from Afghanistan when I asked some researchers verbally in the Kizil Grottoes.

In order to prove this hypothesis, it should be necessary to perform chemical analysis such as elemental analysis and lead isotope ratio analysis. As for that, I found out that there has been no investigation about it.

It was not carried out in this survey, and instead, there has been no research that focused on lapis lazuli when I inquired at Beijing University and the Dunhuang Institute. The chemical research is impossible to conduct by myself in all aspects of knowledge, budget, time and so on.

It cannot be demonstrated yet, but I would like to mention it here as a hypothesis

Next is the history trail of lapis lazuli to Europe. Lapis lazuli went through the Silk Road, beyond the Mediterranean, and brought to Venice in Italy, transmitted western along the Anabasis of Alexander of the Great. Thus, it became called ultramarine as literally "the stone visited over the sea". It was mainly used as a valuable blue pigment for the blue clothes of the Virgin Mary as a symbol of the sacred. In 1437, Cennino Cennini, a second-generation disciple

of Giotto, wrote a book, “The Book of the Art” 《Il Libro dell'Arte》, where the way how lapis lazuli is pulverised, to remove impurities, and coated with resin, that is, the ultramarine pigment refining method and process is described in detail. Also, Marco Polo, who went to China via the Silk Road during the Yuan Dynasty and wrote "Observations of the East" 《马可·波罗》, reported the lapis lazuli pigment recipe in 1271. Lapis lazuli was found in the books of the early medieval in Europe, afterwards, it was frequently used in the drawing from the 14th century, and from the mid-18th century it has been replaced by synthetic pigments, and the amount of usage of natural lapis lazuli has been on a declining trend.

In this way, although lapis lazuli was mined in the mountains of Afghanistan, it was used in Egypt from the 30th century B.C and was also reported as “ruri” 《瑠璃》 to the Far East along with Buddhism inheritance. In the 15th century Italy, artists used it to paint the blue clothes of the Virgin Mary and Vermeer was frequently used. As famous works where lapis lazuli was used, for instance, we can see the clothing of the Virgin Mary at the “Ghent Altarpiece” of Jan van Eyck and the bandanna of “Girl with a Pearl Earring” of Vermeer.

※33 “Girl with a Pearl Earring”

Now about purification from a rock to a pigment, the procedure usually differs by the quality of lapis lazuli. In other words, if the raw ore is of high quality, it may be just pulverised and elutriated, while if it is of low quality, a pure pigment can be obtained starting with some complicated steps. Furthermore, as there appear far more low-quality ones than better, this complicated process is crucial to the purification of lapis lazuli.



When we describe the process, the first step is to burn and heat it and quickly cool it with water. After that, it is made into a fine powder and ground and kneaded together with linseed oil, wax, frankincense resin, turpentine oil. After that, when the paste is immersed in warm water, the pigment comes out. As we can see this complex process, lapis lazuli has been a very expensive pigment. The best pigment was sometimes around the price of gold at that time. Hence its use was also restricted to the painter. For example, it was used for the cloak of the Virgin Mary, and so on, as mentioned above. After that, as an essential turning point, at the beginning of the 19th century, science succeeded in the synthesis of artificial ultramarine by the development of chemical technology. In 1826 Jean-Baptiste Guimet in France and 1828 Christian Gottlob Gmelin in Germany succeeded in synthesising artificial lapis lazuli, then the factory started to produce in the 1830s and contributed to spreading the artificial lapis lazuli. It has a fine texture and shaped rounder compared with the natural one. An artificial lapis lazuli is a vivid, pure colour in an aqueous medium such as glue, vegetable rubber, egg tempera, whereas it becomes a porous layer in an oily medium, and becomes dark blue and black in a thick coating. Therefore, to use as oil paint, it is mixed with lead white or used as a transparent layer on a lower layer drawing from light blue to white.

Regarding the relation between a transparent layer and lapis lazuli, Ichiro Sato refers to so-called “Otsuyu-Gaki” 《おつゆ描き》 of Japanese painters. It is a method used for undercoating oil painting, which means “painting of the upper layer through which the colour tone of the lower layer appears through”. In European languages, it should be equivalent for “glaze” in English, “glacis” in French, and German “Lazur”, which is relevant to the painting technical term. This word in German is derived from “lazuli” of lapis lazuli because of Lapis lazuli's limitlessly transparent blue colour. This transparent blue drawn by lapis lazuli makes the painting technique of “permeable” possible and can only be done with oil paint that can be painted clear. In other words, blue in the West is precisely nearly transparent blue, and it includes transparency as an attribute.

4. 7. The Medicinal Uses of Lapis Lazuli

As mentioned above, we can find three kinds of “blue” in Chinese character. Then, what I would like to tell from this point is an obsession with the colour of blue in the Orient. Furthermore, lapis lazuli, which has been representative of blue, is also appreciated as a sort of supernatural power jewel. To support it, it was believed in ancient Japan that lapis lazuli, which was called “ruri” 《瑠璃》 at that time, was medicine, which contained ingredients to stabilise the spirit, and the polished lapis lazuli was believed to have the ability to drive away. Diseases and to knock down the evil influences.

Here, I would like to remind you again that lapis lazuli in Qinghai. It is said to have been entirely used for medicinal purposes as a hot spring or medicine for drinking.

In ancient Egypt, Lapis lazuli was also used to fit in the eyes of Tutankhamun, while as one example in the Orient, it was used for the name of a Buddhist saint “Yakushi” 《お薬師様》 that has gathered the worldly profit faith in a bodhisattva that cures illness and injury in Japan. Its full name is “Yakushi Ruriko Nyorai” 《薬師瑠璃光如来》 and “Yakushi Nyorai” 《薬師如来》 means a doctor and a pharmacist, as well as a counsellor on physical health, then the word “ruri” 《瑠璃》 is used to emphasise the medicinal efficacy in that "pharmacist".

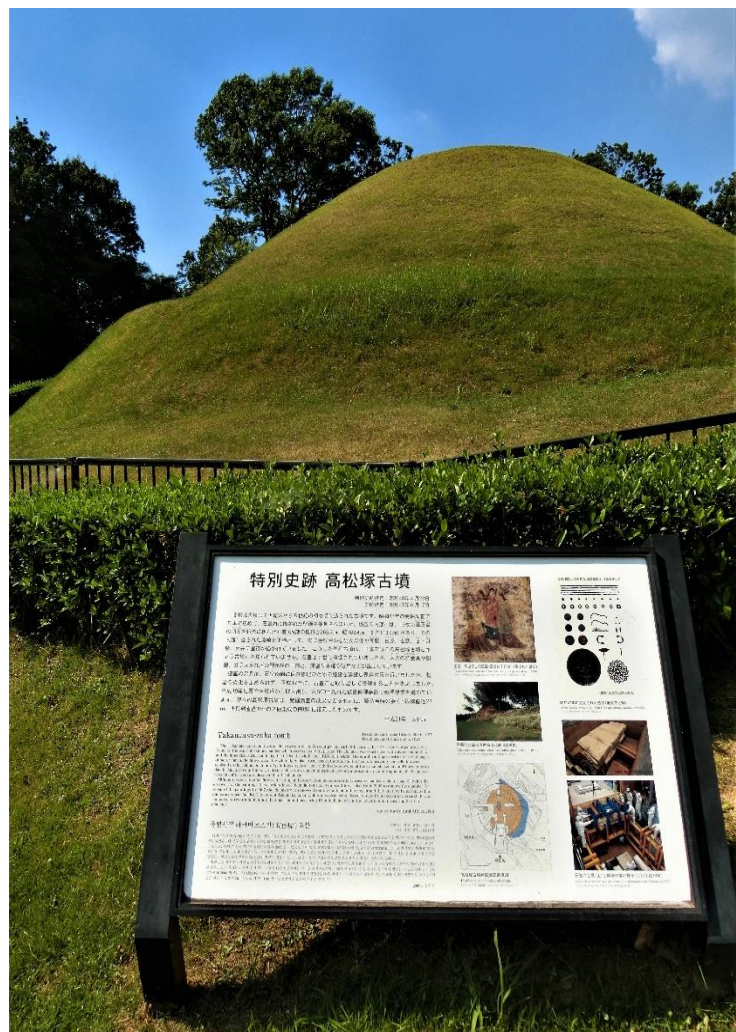
※34 Explanation of the medical hot spring of lapis lazuli displayed at the museum in Qinghai



As another example, the stone set on the crown of the Kudara Kannon 《百濟観音》 in Horyuji Temple (法隆寺), which is said to be established in 607 in Nara (奈良), is reported to be Lapis Lazuli. Additionally, it is believed that the blue pigment used in the murals of the Takamatsuzuka Tumulus 《高松塚古墳》 in Nara was also from Lapis Lazuli. This area “Nara” is considered to be a place where ancient people, called “Toraijin” (渡来人), who had contributed to the civil construction in ancient Japan, migrated from the Korean peninsula and the Chinese continent in the 8th century during the Nara Period. We can see many indications that those who from the continents and the peninsulas had stayed there in ruins and tumuli in Nara. Many of them such as Buddhism were brought via the Silk Road, so in that respect, some scholar has had an idea to seek the easternmost end of the Silk Road from this area “Nara.”

※35 The outlook of the Takamatsuzuka Tumulus

I visited Nara in the spring of 2018 when I studied at Kyoto University, and with permission, I also visited the Takamatsuzuka Tumulus. I got amazed to know that the area of the mound was the place where the descendants of people who came from the Korean peninsula and the Chinese continent in ancient Japan as a Toraijin, which means those who came from overseas) and they were proud of their roots and left behind their remnants. I felt the point of contact with Kizil via the Silk



Road. It is believed that the time when the Toraijin came to Japan was from around the 4th to 7th century, which is almost the same time as the Kizil Grottoes.

As mentioned above, I have explained the origin of Lapis Lazuli and consider where it came from. Now, I think lapis lazuli arrived not only from Afghanistan but also another area. Namely, it should be Qinghai and Tibet, which is closer to Kucha.

※36 The poster of the Takamatsuzuka Tumulus



5. CONCLUSIONS

Finally, as a conclusion, I concentrate on the role and origin of lapis lazuli. Specifically, I focus on why lapis lazuli was used, who used it, where it came from, how it was used (why, who, where from, and how).

5. 1. Role of Lapis Lazuli

In my opinion, the role of the blueness of lapis lazuli in Kizil should be the expression of the sacredness, which is impossible for other colours. As mentioned earlier, blueness can be considered a distinctive colour, as in the ancient times Buddha's surroundings and the heavens were expressed in blue. Moreover, the blue is quite rare especially on a desolate ground like the Silk Road.

※37 Lapis lazuli displayed at the museum in Qinghai



I found that purification of the blue colour had many steps for accuracy, and the blue pigments from lapis lazuli were used very carefully according to its accuracy based on the order of purification with great thought in the combination. Moreover, the latest survey found out that the chemical examination of this research can quantify the accuracy of blue colour.

5. 2. Origin of Lapis Lazuli

The lapis lazuli used in this Kizil cave was traditionally considered to be from Afghanistan, which is the world's largest producer of lapis lazuli. Even when I went to the site and interviewed some researchers in Kizil and visited some jewellery stores in Kucha, I got an answer that lapis lazuli came from Afghanistan.

However, when I went away from Kucha to the museum in Qinghai, I witnessed the exhibition concerning the religion with lapis lazuli for Tibetan (西藏) peoples and its use for medical purposes. Also, lapis lazuli displayed there was from Tibet and Qinghai.

The identification of the place of production requires a chemical examination for the element, and the research has not been conducted yet as far as I checked out past investigations. Therefore, this is just a hypothesis, but I think that lapis lazuli, which was used in such a large amount only in the 224th cave in Kizil, was not from Afghanistan but nearby Tibet. Also, it may be a limited supply of lapis lazuli just for the 224th cave due to some reasons. For example, I think it was due to an assault of other peoples, that is, the Western Turkic Khaganate (西突厥), who was the motif drawn in the Kizil Grottoes

In order to prove this hypothesis, the elemental comparison of lapis lazuli from Afghanistan and China is thought to be the only and best way. However, it has not been conducted yet.

Also, the question of who drew the murals is quite simple: it was the artist's group of the ancient Qiuzi. They did not work alone but worked in a group. Therefore, they could perform large-scale mural paintings uniformly in group work. They drew caves at the request of the powerful people and the Buddhist temples. Contemporary Japanese painters in this survey have admired their high level of work as a fine artist.

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35. outlook of the Takamatsuzuka Tumulus, taken by the author, 23rd July 2018
36. poster of the Takamatsuzuka Tumulus, taken by the author, 23rd July 2018
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8. APPENDICES

The original texts:

- I. 「克孜尔石窟始建于公元三世纪，衰落于公元九世纪，主要表现的是小乘说一切有部“唯礼释迦”的佛教思想。目前已发现的洞窟总数为 349 个，已编号的洞窟有 236 个，石窟呈东西向在绵延约 1.7 公里的明屋塔格山崖体上分层错落分布，并按山势自然走向分为四个石窟分布区域，即谷西区，谷内区，谷东区和后山区，遗存约 10000 平方米壁画和部分彩绘塑像，以及多处窟前建筑构件遗迹。克孜尔石窟作为中国现知最早的大型佛教石窟寺遗址，在世界范围内具有突出的普遍价值；尤其是壁画的独创性和多样性，成为克孜尔石窟艺术的突出成就之一，是佛教艺术史上的一大创举，更是佛教艺术发展承前启后的摇篮」

(in Chinese)

“The murals of Kizil Cave-temple Complex, Mainly reflecting Sakyamuni worship of Sarvastivada school of Hinayana, built from 3rd century and declined from 9th century. There are extant 349 caves, numbered 236, extending from east to west for 1.7 km. The caves are excavated into the cliff of Mingwutage Mountain, and divided into four natural groups: west ravine, inner ravine, east ravine, and rear hill by the natural direction of the mountain. 10000 square meters of murals are preserved with a small number of Color-painted sculptures, and a number of architecture remains in front of the caves. As the earliest, large Buddhist caves remains, the Kizil Cave-temple Cave has the outstanding universal value, and is the cradle, serving the transitional function of the development of Buddhist art because of its prominent achievements about originality and diversity of the murals.”

(in English)

[p.20] *Quoted from the description of the Kizil Grottoes Murals in Kucha*

- II. さて石窟の研究は、まずもってそれらの編年に関する問題を解決することが要件となるが、キジル石窟の場合、今日に至るまで石窟の創建にかかわる紀年銘記や文献の記載は何ら見出されておらず、また直接に対比し得るような比較的系統だった資料もほとんど知られない。したがって、この石窟の編年について考究することは、はなはだ困難をとまなう今世紀の 30 年代以前、ドイツ隊は新疆各地から大量の石窟資料を持ち去ったが、彼らはインドのガンダーラや西アジアの美術の特徴にもとづき、キジル石窟に関係ある供養者題記、壁画中のブラーフミー文字の字体やキジル第 67 窟（Rotkuppelhöhle 紅穹窿窟。ドイツ隊呼称による。以下略）発見の亀茲文古文書を参考としつつ、さらに 13～14 世紀のチベット仏教徒の記録等によりながら、特にその壁画様式に重点をおいて、これら新疆地方の石窟壁画の編年に関しては、少なくとも三つの時期が想定できるとした。しかしながら、これら 3 期の区分について共通していえることは、それが新疆各地の歴史、とりわけ仏教伝播の歴史的背景についての細かな考察を欠き、しかも、新疆以東のいくつかの主要石窟の状況を考慮していないことであり、彼らはその推論の可否について、少しも疑うことがなかった。1946 年から 47 年にかけて、中国朝鮮族の画家韓樂然氏は 2 度にわたってキジルを訪れ、壁画を模写するとともに、その間、キジル石窟壁画の編年とそれら相互の比較検討を行った。ただ、氏の手稿や模写、および氏自身が解放直前に思わぬ難をこうむったのは遺憾なことであった。解放後、1953 年の西北文化局新疆文物調査班に参加した常書鴻氏と、1963 年の中国仏教協会・敦煌文物研究所合同の新疆石窟調査班に加わった閻文儒氏は、ともに新疆各地の石窟について全面的な考察を加え、キジル石窟の編年に関する新たな見解をそれぞれ発表した。常・閻 2 氏の仕事は、いずれも長年にわたって敦煌石窟およびこれ以東の重要な石窟を研究してきた豊富な経験を基礎として進められたものであり、おのずからドイツ隊の見解とは異なるものであった。北京大学歴史系石窟考古実習班と坪城県キジル千仏洞文物保管所は、もとの国家文物事業管理局と新疆ウイグル自治区文化局、同自治区文物管理委員会の支援をうけ、共同でキジル石窟の考古調査を開始し、一部石窟遺跡の発掘調査を進めるとともに、亀茲地方の石窟の形式分類とその変遷に関し、基

礎的検討を行なった。この間、北京大学歴史系石窟考古教研室実験室は放射性炭素 C14 による年代測定を分担し、その結果は、上述の形式結論と変遷について現段階における一応の結論と基本的一致をみた。

[p.33] *Quoted from the thesis of Su Bai (1984)*

- III. この石窟はクチャ地域で最も主流となる中心柱形式の石窟構造を有し（図三）、前室の左右後壁に比丘供養図と王侯供養図が描かれていることから、王家の寄進と庇護をうけて造営された石窟であることがわかる。この王侯供養図の中に、キジル第二〇五窟主室前壁右側に描かれた王侯供養図中のスヴァヤムプラヴァー妃 Svayamprabhā（図四）と同じ帽子を被った女性が描かれており（図五）、両窟は同一人物、同一集団の寄進による造営の可能性が高い。このことは石窟構造と規模、および仏説法図の主題や図像プログラム等の類似性からも肯首できよう。しかし両者は高い類似性をみせる一方で、色調や人物造形等に異なる点が見られる。熊谷、上野の両氏はキジル第二二四窟の壁画の特徴を以下のように述べている。

第三区摩耶洞（第二二四窟）の色調は青灰色、橙丹色、淡黄土色、白色等の使用多く中間色的であり隈取りが薄く、描線も伸びやかであるのに比較して、第二区摩耶洞（第二〇五窟）の青色、赤褐色の調子はどぎつく、隈取り強く、描線も堅苦しいと云えよう。（熊谷、昭和二八年、一二九頁）

これら（筆者注：キジル第二二四窟）の断片に共通する特色は、美しい青色が随所に用いられていること、上部あるいは下部に青い縁のある白い帯状の部分を持つものの多いこと、また描線が柔軟で第二区マヤ洞にみるような完成した、緊頸な線ではなく、くまどりのきつくないおだやかな顔貌表現をとるという点である。（上野、一九八〇―一、一五頁）

両者ともに似たとらえ方をしているが、特に題記を書く白い帯状区画の上下の青い縁取り線に着目する上野の指摘は重要である。純度の高い青い縁取り線によって縁取られた白い帯状区画が、キジル第二二四窟かどうかを判断する重要な手掛かりとなった。ドイツの様式分類によれば両者は同じ第二様式に属し、寄進者も同一グループであると推測されるが、同一工房の手になるものとは考えにくい。

この窟のもう一つの特色に純度の高いラピスラズリの青と金箔、金属箔の併用が挙げられる。この傾向は、キジル第一三窟、第三八窟、第六九窟（上層の壁画）、第一七一窟、第二〇五窟、第二二四窟にみられ、第三八窟（跪坐する世俗人物の供養図）、第一三窟（比丘供養図）以外の四窟に王侯供養図を表していることが共通する。これらの石窟では、金箔の使用は主室側壁の仏説法図と正壁仏龕に見られるが、キジル第二二四窟のみ、主室の側壁（前壁も含む）や正壁だけでなく、天井、側廊、後廊にまでおよび、ラピスラズリの青の輝きと金箔、金属箔による輝きの相乗効果、豪華さは他に例をみない。

キジル第二二四窟の年代については、橘堂晃一の指摘がひとつの目安となろう（橘堂晃一、二〇一〇）。キジル第二二四窟後廊前壁の「荼毘」上部の哀悼の身振りをする人々の中に亀茲人に交じって髪を後ろに長く伸ばした辮髪の人物が描かれている（Grünwedel, A., 1912, op.cit., Fig.415.）。橘堂は、顔や身体を傷つけて死者を哀悼する行為は、遊牧民に特徴的な風俗で、キジル第二二四窟の「荼毘」上部に描かれた哀悼供養の表現は遊牧民である突厥、特に西突厥の風俗の影響を受けたものであり、辮髪の人物は突厥人を表したものと推測している。卓見であるといえよう。とすれば、この石窟は西突厥が西域を支配下においた六世紀中葉以降の制作と推測することが可能となる。キジルの石窟に使用される材料や顔料の質が急に豪華になった印象を抱くが、西突厥の支配と何がしかの関係があるのか今後の検討課題である。

[p.35] *Quoted from the thesis of 中川原 (2016), p. 56*

- IV. 第3区摩耶洞（第224窟）の色調は青灰色、橙丹色、淡黄土色、白色等の使用多く中間色的であり隈取りが薄く、描線も伸びやかであるのに比較して、第2区摩耶洞（第205窟）の青色、赤褐色の調子はどぎつく、隈取り強く、描線も堅苦しいと云えよう。

[p.36] *Quoted from the thesis of 中川原 (2016), p. 56*

- V. これら（筆者注：キジル第224窟）の断片に共通する特色は、美しい青色が随所に用いられていること、上部あるいは下部に青い縁のある白い帯状の部分を持つものの多いこと、また描線が柔軟で第2区マヤ洞にみるような完成した、緊勁な線では無く、くまどりのきつくないおだやかな顔貌表現をとるという点である。

[p.37] *Quoted from the thesis of 中川原 (2016), p. 56*

- VI. 「絵画は観照者の脳裏に宿る。が、手の操作を待たずしては完成に到達し得ない。絵画について言えば、学問的で自明的な原理として、先ず影をつくる立体とは何かをおき、それから一次的な影、二次的な影とは何か、明るさとは何か、つまり闇、光、色、それからさらに立体、形、位置、遠、近、動と静とは何かをおく。以上のものは、手の働きなくして、ただ脳裡で理解されるものであり、これが観照者の脳裡にきざす絵画学というものであるが、そこから、やがて前述の観照とか学問とかよりも、はるかに高度な制作ということが始まるのである。」

[p.40] *Quoted from Sato, 2014, "Oil Painting Technique and Material", p. 24*

- VII. 「「見ること」「描くこと」の行為を通して、絵画は基本的に成立する」「それらの行為を実現するためには、絵画材料と絵画技術が必要である」

[p.41] *Quoted from Sato, 2014, "Oil Painting Technique and Material", p. 2*

- VIII. 絵画は、基本的に色のもとをなす粉である顔料と、それを寝襟合わせてペースト状にし、木板（パネル）や麻布（キャンバス）などの支持体上の地塗りに固着する役割も果たす媒剤（メディウム）からなる。

さまざまな色調の絵具がパレットに揃うには長い時間がかかった。入手しやすい顔料はまず土である。黄土（イエローオーカー）、赤土、緑土（テルベルト）などで、古代ではこうした土を顔料に使った。その後、エジプト、ギリシア、ローマなどでは、さまざまから岩石などから水銀朱（パーミリオン）（辰砂）、青金石（ラピスラズリ）（群青）、岩群青（アズライト）、岩緑青（マラカイト）などの顔料が作られる。色を含む鉱石を粉末にすれば、顔料になる。そして、13、14世紀の中世になって、錬金術が発達し、交易が進んでくると、さまざまな顔料が手に入るようになった。

染料である藍は、水酸化アルミニウムなどの屈折率の低い体質顔料に染色され、さらに鉛白などの白色と混ぜて使われた。染料のままでは、油などの媒剤に混ぜると溶液化してしまい、絵具として使えない。

18、19世紀になって、プロシア青（プルシャンブルー）、コバルト青（ブルー）、カドミウム黄（イエロー）、クロム黄（イエロー）など合成無機顔料が次々と開発され、一気にパレットの色は豊かになる。希少だったラピスラズリ（天然ウルトラマリン）も1828年に合成ウルトラマリンが開発された。さらに20世紀になり、合成有機顔料が開発される。赤色顔料ではアゾ系、キナクリドン系、緑色、青色であればフタロシアニン系などである。

[p.42] *Quoted from Sato, 2014, "Oil Painting Technique and Material", p. 3*

- IX. 「小さな子供にたずねられたら
海の碧さをもう一度伝えるために
今 瞳を閉じて
今 瞳を閉じて」

[p.49] Quoted from Yumi Arai, 1974, 『瞳を閉じて』

- X. チェンニーノ・チェンニーニ 『絵画術の書』辻本茂編訳「第 62 章 オルトレマリーノの性質とその作り方」

オルトレマリーノは、すべての顔料を凌駕して高貴で、美しく、完璧な顔料であり、これ以上のものは、他に挙げることも、つくことも出来ないであろう。かように、この顔料は優れたものであるから、これについては、詳しく扱うことにし、製法も十二分に説明しておきたいと思う。だから、よく注意して聞くように。そうすれば、大いなる荣誉と実益を、それから得るであろうからである。この顔料は、金—それは、われわれのわざに属するあらゆる仕事を華やかに彩るものであるが—とともに用いられると、それが壁であろうと板であろうと、ことごとくのものに輝きをもたらす。まずはじめに、ラピスラズリを用意する。もし良い石を見分けたいと望むなら、お前が見て、青色の豊かなものを選ぶように。なぜなら、この石は、灰のような部分が全体に混ざり合っているからである。この灰の色が少ないものほど上等である。だからといって、まるでズマルトのように、見た目にたいそうきれいな群青の原石と、見間違えないように注意し給え。青銅の乳鉢に覆いをして、粉が外に飛び散らないようにして搗き砕く。次に砕いたものを斑岩の上に置き、水を加えずに磨り潰す。それから、薬種商が薬を篩にかけるのに用いる蓋つき篩を用意する。それを篩にかけ、再度必要なだけ搗き砕く。心すべきは、細かに挽けば挽いただけ濃い董色の美しさは失われてしまうということである。この顔料の細かいものは写本彩飾画家にとっていっそう有用であり、衣裳の明部を描くのによい。上述の粉末が用意出来たら、薬種商から、ラピス・ラズリ 1 リブラにつき、松脂 6 オンチャ、乳香 3 オンチャ、採取されたばかりの蜜蝋 3 オンチャを買ってくる。これらすべてを、新しい小鍋と一緒にに入れて溶かす。次に、白い麻布を用意し、釉薬のかかった鉢の中に、これらを濾して入れる。ついで、ラピス・ラズリの粉末 1 リブラをとり、全部を一緒によく混ぜて、すべてをひと固まりにした捏ね物をつくる。この捏ね物を手際よく扱うためには、亜麻仁油を用意して、この油をつねに両手に塗っておくことである。毎日少しずつ捏ねながら、少なくとも 3 日 3 晩は、この捏ね物を寝かしておかなければならない。この捏ね物は、半月でもひと月でも、お前の望むだけ、そのままにしておくことは出来る、ということを頭に入れておき給え。青の顔料をそこから抽出しようとするときは、この方法でやり給え。太すぎも細すぎもしない丈夫な棹から、2 本の棒をつくる。各々を 1 ピエ（フィート）の長さにして、両端を円く削り、十分に磨きをかけておく。そして次に、捏ね物を貯蔵しておいた釉薬のかかった鉢をとり、その中に適度に暖めた灰汁を、お碗 1 杯分ほど注ぐ。そして先の 2 本の棒をそれぞれ両の手に持って、この捏ね物をひっくり返し、押しつけ、あちらこちらへと搗きまぜる。それは、パンをつくるために練り粉を手で捏ねるのとまったく同じ要領である。これをやって灰汁が完璧な青色になったら、釉薬のかかった碗にこの灰汁を移す。次に、同量の灰汁をとり、その捏ね物の上に、もう一度注ぐ。例の棒で、先程のように行う。灰汁がふたたび充分な青色になったら、釉薬のかかった別の碗にそれを入れる。そして、また、同量の灰汁を捏ね物に注ぎ、同様の方法で再度行う。こうして、灰汁が充分青色になったら、釉薬のかかった別のもう一つの碗に入れる。同じことを何日もかけて行い、捏ね物が、灰汁をもうや色で染めないようになるまで、続けるのである。こうなったら、それはもう役に立たないので、捨ててしまう。

次に、お前のまえの台上に、これらの碗を全部、順序よく並べる。すなわち、第 1、第 2、第 3、第 4 というように、それぞれの抽出された順序にしたがって、並べるのである。青顔料は、重さにしたがって底に沈んでいるであろうから、手で、灰汁を青顔料とともに攪拌してみると、抽出された青がどんな色合いであるかが分かるであろう。お前の欲しい青は何種類か、つまり、3 種類か、4 種類か、あるいは 6 種類か、お前の欲しいだけの種類

の数を、自分でよく考えて決めるように。第1の碗のものは第2のものより質がよいというふうに、初めの方で抽出されたものほど良質だということを、頭に入れておき給え。そこで、もし18箇の碗に入った抽出物があるとして、3種類の青をつくりたいと思うなら、その内の6箇を取って一緒に混ぜ、それを一つの碗にまとめる。こうすることで、1種類の青が出来るであろう。他の2種類についても、同様に行う。しかし、使用したラピス・ラズリが良いものであるなら、最初に抽出された二つは、1オンチャにつき8ドゥカートもする高価なオルトレマリーノ青（この価格をグラムあたりに換算すると、オルトレマリーノは1グラム0.28ドゥカートになる。1400年頃の年頃の1ドゥカート金貨の重量は、約3.45グラムであったため、1グラム0.29ドゥカートになる。）であるということをおき給え。しかし最後に抽出された二つは、灰にも劣ると言てよい。

だから、質の良い青を質の悪いもので台無しにしないよう、眼を慣らしておくように。先の灰汁の入った碗は、毎日、日に干して、この青顔料を乾燥させるように。十分に乾燥したら、その量と情況にしたがって皮袋、膀胱、巾着などに入れるのである。もし、上述のラピス・ラズリの石がそれほど上等のもでなかったばあい、あるいはこの石を粉碎しても青が濃い董色に見えないばあいは、それに少し色を加えることを教えよう。砕いたグラナ少量と、蘇芳少量をとり、一緒に煮る。しかし蘇芳は、おろし器ですりおろすか、ガラスで削ぎ落すように。次に、それらに、灰汁と、少量の明礬とを加えて、一緒に煮る。煮えると、完璧な深紅色となるであろう。お碗から青顔料を取り出す前に、しかし、その灰汁が十分に乾燥していることを確かめた上で、その上に、このグラナと蘇芳の煮汁を少量たらし、指で全体をよく混ぜる。それを、太陽や火や風にはあてることなく、そのまま乾燥するまで放っておく。乾燥したら、皮袋か巾着に入れて貯蔵しておく。それは質の良い完璧な青顔料である。これを上手につくるすべを知ることは、特別の技倆であるので、しっかりと掴んでおくように。しかし、これをつくるのは、男よりも、美しい娘たちの仕事であることを知っておくように。なぜなら、娘たちは、いつも家にじっとしており、繊細な手をしているからである。ただし老婆は避けるように。上述の青顔料を用いようというときは、必要な分量だけをとるようにする。明るい衣裳を描こうというのなら、いつもの石の練り板の上で少し練る心要がある。色面でそれを用いようとするのなら、石の上で磨るのはほんのごくわずかでよい。水は、いつでもごく澄み切ったものを用い、石はよく洗ってきれいにしておくように。そして、もしも青顔料が、何かで汚れているようなことがあったら、灰汁かきれいな水の少量をとって小壺に入れ、両者を一緒にしてよく掻き混ぜる。これを2、3度繰り返すと、青は、十分にきれいなものとなるであろう。その結合剤についてはここでは触れないが、もっと後で、板、壁、鉄、紙、ガラスなどで用いる顔料のそれぞれについて、適当な結合剤を、すべてまとめて説明することにしよう

[p.52] *Quoted from Sato, 2014, "Oil Painting Technique and Material", p. 18-22*

- XI. 「ラピスラズリの藍色の鉱物は、方ソーダ石として一括されるいくつかの鉱物のひとつです。方ソーダ石族の鉱物はどれも同じ結晶構造をもっており、アルミニウムまたは珪素を四つの酸素が囲む四面体が、...立体的につながった骨組みをつくっています。しかし、骨組みの間に比較的大きな空間があって、この空間にいろいろのイオンが入ることが出来ます。方ソーダ石ではナトリウムと塩素が入り、ノゼアンではナトリウムと四酸化硫黄が入っています。ラピスラズリ（青金石）ではここに、ナトリウム、カルシウムと硫黄、四酸化硫黄、塩素が入っているのです。したがって、ラピスラズリは一種の固溶体ということが出来ます。」

[p.56] *Quoted from 白水春雄 青木義和, 1989, 『宝石のはなし』*